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Women's political empowerment and economic growth ☆

Sirianne Dahlum [a,*], Carl Henrik Knutsen [a], Valeriya Mechkova [b]

[a] University of Oslo, Norway
[b] University of Gothenburg, Sweden

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ABSTRACT

We investigate whether and how women's political empowerment relates to technological change, the main driver of long-term economic growth. We argue that three aspects of empowerment – descriptive representation, civil liberties protection, and civil society participation – advance technological change and thereby economic growth through (a) increasing the number and variability of new ideas introduced in the economy and (b) improving the selection of more efficient ideas. Drawing on data from 182 countries and 221 years, we test various implications from our argument. Women's political empowerment is positively related to subsequent economic growth. This relationship persists across various model specifications and when accounting for different potential confounders. The three sub-components of empowerment are also, individually, related to growth, although not as strongly as the aggregated concept. The relationship is retained across different contexts, but is clearer for "Non-Western" countries and in earlier time periods. We also find evidence that women's political empowerment enhances technological change.

1. Introduction

Technology and innovation are often associated with masculinity, with women being largely invisible both as users of technology and creators of change (Lie, 1995; Finson, 2002). Yet, history is filled with women who have defied this traditional understanding and devoted their lives to innovation and creative activities, contributing to the development of society. In *The Forgotten Women*, Tsjeng (2018) portrays the successes but also hardships that women innovators have faced throughout history, being excluded from universities and academic societies, forced to resign as scientists after marriage, or having their achievements credited to male collaborators (pp. 14–16). Gendered discrimination in science and innovation is not unique, but has, historically, mirrored exclusion of women and discriminatory practices more generally, both in political life and the wider economy. What would the world look like if women did not face these kinds of exclusion and discrimination? We contribute to answering this question by focusing on the potential benefits from women political empowerment on technological change and, as a further consequence, economic growth.

The existing academic literature emphasizes the positive economic (and other) effects of including various social groups, especially women, in different positions and processes. However, extant work has focused mainly on socio-economic aspects of empowerment, particularly women's labor participation and education access, in enhancing economic growth (Duflo, 2012; Esteve-Volart, 2004; Cuberes & Teignier, 2012; Klasen & Lamanna, 2009). The economic effects of *political* inclusion of women remain less studied. Another literature has scrutinized, for decades, to what extent political institutions affect economic development, often establishing a strong, positive association (North, 1990; Rodrik, Subramanian, & Trebbi, 2004; Gerring, Bond, Barndt, & Moreno, 2005; Acemoglu & Robinson, 2012). Nevertheless, we still lack a clear understanding of which specific institutions are more and less important for development. Moreover, this literature has mainly theorized and studied how institutions influence capital investments, although growth economists suggest that technological change is *the* main driver of long-term growth (Helpman, 2004).

In this paper, we bridge these two literatures and address the mentioned research gaps by considering how the political empowerment of women affects technological change, and thereby

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* Corresponding author.
E-mail address: sirianne.dahlum@stv.uio.no (S. Dahlum).

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countries' trajectories of economic growth. We conceptualize women's political empowerment (WPE) as the increased capacity for women to influence political decision-making, which can be furthered via three pathways: (1) political representation in decision-making; (2) freedom of choice, guaranteed by protected civil liberties; and (3) opportunity to organize and effectively express one's voice (Sundström, Paxton, Wang, & Lindberg, 2017). While a normative ideal in itself, we highlight how WPE also has instrumental value in enhancing other important outcomes. Since women constitute the mathematical majority of the adult population in many countries, and close to the majority in most other countries, including or excluding them as policy-makers as well as equal participants in public debates may have substantial consequences for the economy. Specifically, we outline how open and inclusive institutions that promote WPE enhance technological change through increasing the number and variability of new ideas introduced in economic policy-making and the economy *and* by improving the efficiency with which the best new ideas are adopted.

We propose that the overall relationship stems from a combination of mechanisms related to all three aspects of WPE. First, bringing women into politics expands the country's political talent pool and increases the variance in relevant characteristics of representatives, such as types of experience and knowledge (Sapiro, 1981; Khan, 2017; Clayton, Josefsson, Mattes, & Mozaffar, 2019). This is expected to have tangible effects on public policies (Phillips, 1995), including those affecting the economy. Second, the protection of civil liberties, including freedoms of speech and movement, allows for open and critical exchanges, increasing the flow of ideas and enabling the selection of the better ones (Knutsen, 2015). Improving the protection of civil liberties for about half the population will greatly boost such processes. Third, giving women the opportunity to voice their concerns, ideas, and solutions through the civil society and media enriches the available information to policy-makers, enabling them to select more efficiency-enhancing economic policies (Parks et al., 1981; Evans, 1995; Weldon, 2002). All of these mechanisms point towards the political empowerment of women enhancing technological change (broadly defined as changes in how a given set of inputs are combined to produce outputs) and productivity growth, and thereby economic growth.

Our proposed mechanisms on how the political empowerment of women translates into improved idea diffusion and selection are general in nature. Although the exact nature of empowerment as well as the ideas that are diffused and selected will certainly differ, we thus expect these types of mechanisms to apply across different geographical and historical contexts. Further, both technological change and changes in WPE are often slow-moving processes that are inevitably hard to measure precisely. Hence, both theoretical and econometric considerations suggest that we require extensive data material to capture any relationship between our variables of interest. Fortunately, we can draw on data from 182 countries and 221 years to offer the first comprehensive test of the relationship between women's political empowerment and economic growth. Specifically, we use a recently developed index on "Women Political Empowerment" from Varieties of Democracy (V-Dem) (Coppedge et al., 2020; Sundström et al., 2017).

We find robust evidence that WPE is positively related to subsequent GDP per capita growth. The substantive size of the estimated relationship is also considerable, suggesting that improvements in WPE correspond to large gains in economic development over the long run. The relationship holds up when accounting for initial differences in economic development, past trends in growth, democracy levels, state capacity, country-specific time trends, country- and year-fixed effects, and several other potential confounders. When disaggregating WPE into its sub-components, we find that descriptive political representation, civil liberties protection, and civil society participation are all, individually, related to growth, following our theoretical expectations. Although we expect the proposed general mechanisms to apply in different societies, we cannot exclude the possibility that they apply more strongly in some societies than others. Hence, we assess the heterogeneity of the relationship across different regions, historical periods, and regime types. While we do find indications of heterogeneity – the relationship is, for example, stronger and more robust for "Non-Western" countries and in autocracies – the overall relationship between WPE and growth is retained across different contexts. Finally, we find evidence that WPE enhances total factor productivity growth, a proxy for technological change. This measure excludes growth induced by changes in labor hours, physical capital and human capital, allowing us to focus more precisely on the theorized mechanisms.

Our paper adds to a long-standing, multi-disciplinary discussion on the political determinants of economic development by detailing the role of women's political inclusion, more specifically. Beyond the academic contributions, our study and findings potentially have real-world relevance. Women's political empowerment has intrinsic normative value, and additional motivation for ensuring equal participation and protection of rights across genders *should* therefore not be needed. Insofar as women's rights are human rights (Bunch, 1990), women should have the same basic opportunities as men, including an equal say in decisions on how to govern society. Yet, countries across the world still vary extensively in exactly how empowered women are. The "business case" for women's political empowerment that we present might have the potential to nudge initially hesitant leaders and powerful groups – albeit for instrumental reasons – to empower women. Additionally, we conjecture that our theoretical argument and findings could be relevant for understanding how political inclusion, more generally, influences technological change and economic growth. While our theoretical argument can certainly be extended to the political empowerment of other groups such as sexual or ethnic minorities, we leave the empirical study of such relationships to future research and focus here on the inclusion of women.

2. Relevant literatures

In this section, we review the theoretical and empirical literatures that serves as building blocks for our subsequent argument. We first review studies on (deep and immediate) determinants of economic growth, focusing on arguments and evidence pertaining to how institutions shape technological change. Next, we review studies addressing how different aspects of women's empowerment influence economic outcomes.

2.1. Economic growth, and the role of institutions

Growth economists have, for decades, studied the "immediate determinants" of GDP growth (Helpman, 2004). Several theoretical models specify how such determinants feed into growth processes (Mankiw, Romer, & Weil, 1992; Romer, 1990) and growth accounting exercises have assessed how much of growth in GDP comes from each determinant (Klenow & Rodriguez-Clare, 1997; Baier, Dwyer, & Tamura, 2006). Immediate determinants are either classified as factor inputs in production processes – notably labor hours, physical capital, human capital, land, and natural resources – or as "technology", broadly conceived as the way in which the inputs are combined into producing output.[1] When we use the term "technology" below, we employ this broad definition, which is con-

[1] We remark that the sharp distinction between how factor inputs and technology feed into growth is a simplification; investments in new machinery may introduce new technology (Nelson, 2005) and high human capital levels facilitate the adoption of more efficient technologies (Kremer, 1993).

ventional in growth economics (see, e.g., Helpman, 2004). Hence, technological change refers to any change in organization and production processes that changes the mapping from production inputs to outputs, and technological progress over a time periods simply means that more output can be produced (at the end of the time period) for the same amount of labor, capital and human capital inputs. This broad technology concept covers specific production technologies, but also ideas about economic policies and how economic processes are organized insofar as they may affect how, and how efficiently, inputs are combined into outputs. The presumed relative importance of different immediate determinants in influencing short-, medium-, and long-term growth varies across theoretical models. Yet, the most prominent ones – both among so-called neo-classical- and endogenous growth models – highlight that accumulation of factor inputs may boost growth in the short- to medium term, but not in the longer term (as returns to accumulating more inputs decrease). In contrast, technological change drives (also) long-run growth.

Technological change may be sector-specific or pertain to the wider economy. Further, it can come from (numerous) incremental adjustments in equipment or production processes or from the adoption of major innovations such as the assembly line, computers, or double-entry bookkeeping. Importantly, the introduction of new ideas and production technologies to an economy can come from domestic innovation *or* from the adoption (and possibly adaptation) of technology developed abroad. Hence, while many people associate "technological change" with advanced breakthrough innovations in particular sectors, the term is much broader and encapsulates incremental improvements and the adoption and use of decades-old ideas and innovations in sectors and societies where they have heretofore not been used.

Yet, several economists focus primarily on processes of innovation for understanding technological change. Romer (1990) introduces a "new growth model", where profit-maximizing firms contribute to technological change by innovating and supplying a wider variety of new products. Grossman and Helpman (1991) and Aghion and Phillipe (1992) model technological change as generated by firms investing in innovation of improved products that replace existing products of inferior quality. But, since ideas are "non-rivalrous" (Romer, 1993), production and organization technologies can, at least in principle, be used to enhance efficiency also in other countries than where they originate from. Indeed, most production and organization technologies in use in any current economy – especially small and poor ones – come from abroad. In order to understand technological change, and thereby persistent differences in growth rates across countries, the arguably most important question to understand is why some countries are better than others at adopting production techniques and ideas developed elsewhere, and at diffusing them within their economies.

So-called "evolutionary growth models" (see, e.g., Nelson, 2005; Verspagen, 2005) are relevant in this regard. These models draw on notions from evolutionary biology to assess which factors enhance the adoption of new and more efficient technologies. The two key inputs to such processes are (a) an *increased variety of new ideas* being introduced to the economy – partly from domestic innovation, but notably through diffusion of ideas from abroad – and (b) mechanisms for ensuring the *selection of the more efficient ideas*. A large variety of competing ideas enhances economic efficiency especially when it is unclear *a priori* how ideas and technologies will work in practice; economic actors learn how effective they are from trial and error processes (North, 2005). Regarding selection, this process reduces variety as new techniques are adopted through learning and less efficient organization and production techniques are discarded. An economy thus requires the steady introduction of novel ideas to keep up variety. Factors that simultaneously allow for the introduction of new ideas and enable improved selection and diffusion processes are therefore especially likely to enhance technological change. This insight is central in our theoretical argument below.

So-called *deeper determinants* of economic growth (Rodrik et al., 2004) are located prior in the causal chain to the immediate determinants. Suggested deeper determinants include cultural norms and practices, various geographic features, and demographic factors, but the perhaps most widely studied one is "institutions" (e.g., North, 1990; Rodrik et al., 2004; Acemoglu, Johnson, & Robinson, 2001; Acemoglu & Robinson, 2012). By influencing which economic policies are selected, and thereby determining expected costs and risks to investors, institutions presumably affect capital accumulation (North, 1990). But, more importantly for long-term growth, institutions may also influence innovation and the adoption of new technologies. For example, institutions ensuring the protection of intellectual property rights can strengthen incentives for firms to invest in innovation activities (Romer, 1990). Further, protection of civil liberties (Knutsen, 2015) or competitive multi-party elections (North, Wallis, & Weingast, 2009) may enhance both the *variety* of ideas introduced into the economy and improve *selection* of the more efficient ones; open and inclusive political institutions "more readily generate a range of solution to problems; they more readily experiment with solutions to problems; and they more readily discard ideas and leaders who fail to solve them" (North et al., 2009 134). By enabling different population groups – and thus more creative minds – to enter policy debates and partake in economic interactions, open and inclusive institutions may enhance technological change, and thereby growth. Despite the plausibility of this argument, scholars have yet to establish which particular institutions matter the most for spurring technological change.

2.2. Economic consequences of women's empowerment

Several studies have proposed that gender equality and empowerment of women influence economic outcomes, including growth (see Cuberes & Teignier, 2014; Duflo, 2012; Kabeer & Natali, 2013). Yet, most studies focus on socio-economic aspects of female empowerment, especially female labor participation and education outcomes.

Regarding the former, Esteve-Volart (2004) presents a theoretical model indicating negative economic consequences of excluding women from labor participation. In this model, individuals are born with a given talent, and restricting the access of women to managerial positions leads to loss of talent in the positions where they are the most productive – this assumption is backed up by empirical research on the performance of women in various business activities (Chaganti & Parasuraman, 1997; Kalleberg & Leicht, 1991). Such exclusion of women therefore gives diminished innovation and slower technology adoption, thereby reducing productivity growth.

Further, Esteve-Volart (2004) highlights how more general restrictions on the type of work women can do, notably being restricted to only home production, reduces income due to the lower productivity in this sector. Finally, both types of exclusion – from managerial positions and from production in certain sectors – leads to lower investment in human capital, further reducing growth rates. Similarly, building a model of heterogeneous talents, Cuberes and Teignier (2012) show how barriers for women to become managers significantly reduce the average talent available in the economy, and thereby aggregate productivity and income levels.[2] Their cross-country estimates indicate that the GDP per cap-

[2] Additionally, enabling women entrepreneurs could enhance economic growth also by *diversifying* the types of entrepreneurial activity present in the economy (Nissan, Carrasco, & Castaño, 2012).

ita loss is about 12 percent when women cannot take managerial positions, and about 40 percent when women are completely excluded from the labor market. The estimated income loss (in the mid-2000s) for countries in the Middle East and North Africa, where exclusion rates are the highest, is 27 percent.

Several studies suggest that gender gaps in education hurt economic growth directly due to reduced human capital, with potential ramifications also for technological change (Klasen, 2002; Klasen & Lamanna, 2009; Knowles, Lorgelly, & Dorian, 2002; Thévenon, Ali, Adema, & and del Pero, 2012). Educating women also carries other externalities such as reduced fertility and improved child-care and child survival, which enhance the human capital of future generations (see Mitra, Bang, & Biswas, 2015; Duflo, 2012; Imai, Annim, Kulkarni, & Gaiha, 2014) Using panel data, Klasen and Lamanna (2009) and Thévenon et al. (2012) investigate the effects of gender gaps in education and labor force participation and find that gender gaps are associated with reduced economic growth. In OECD countries, on average, an additional year of education for girls is estimated to give 10 percent higher GDP per capita (Thévenon et al., 2012). Similarly, analyzing data from 1992–2006 in rural India, Imai et al. (2014) find that the mother's education relative to the father's is related to better nutritional status of children. These positive findings are corroborated in a systematic review and meta-analysis on gender inequality in educational attainment and economic growth (Minasyan, Zenker, Klasen, & Vollmer, 2019).

While the literature convincingly shows that the inclusion of women in the economy is positively related to economic growth, we know less about the effects of women's *political* inclusion. Mitra et al. (2015) argue that gender equality is a multidimensional concept, consisting of distinct features that may have different effects on growth. They find that equality in economic opportunity (index of literacy gap, secondary enrollment gap and fertility rate) is associated with growth in developing economies, while equality in economic and political outcomes (index of labor force participation gap and percent women in parliament) displays this association in developed economies. Yet, this study only focuses on one aspect of women's political empowerment, namely women in parliament. And, Mitra et al. (2015) consider a limited time period, from 1990–2000, for around 100 countries. Hence, we still lack in understanding of exactly how the political empowerment of women, along different dimensions, affect economic growth. In the following, we argue that different aspects of women's political empowerment have positive implications for technological change. Although the relevance and strength of the mechanisms might vary across contexts, the general nature of the mechanisms that we outline lead us to expect that these relationships are present in both developing and developed countries.

3. Argument

Rather than focusing on whether women have access to particular resources such as education or land, we consider women's access to political power and their ability to influence distribution of resources and decisions, more generally (Longwe, 2000). Following Sundström et al. (2017), we adopt a broad definition of WPE as "a process of increasing capacity for women, leading to greater choice, agency, and participation in societal decision-making". Hence, we go beyond descriptive political representation and also cover freedom of choice and ability to voice ideas and preferences for all women. This is relevant insofar as our argument pertains not only to the difference that women can make in the economy as policy-makers, but also in their every-day lives as creators of change. Specifically, the concept that we employ has three subcomponents. The first one relates to improved representation for women in key arenas of political decision-making, including the legislature and executive. The second pertains to enhanced freedom of choice for women in different spheres, notably coming from strengthened civil liberties. The third pertains to women being able to actively voice their preferences and ideas through civic participation of different kinds.

Fig. 1 illustrates the main steps in our argument. We surmise that all three sub-components have independent effects on the variety of new ideas introduced into wider society and the economy *and* the selection of more efficient ones. These are the two key determinants of technological change, according to the evolutionary growth models reviewed above. By increasing the variety of new ideas pertaining to economic policies, organization processes, and product technologies, there is greater room for coming across new ways of organizing and producing in a manner that yields more *or* better outputs for a given amount of capital, labor and other factor inputs. Yet, greater variety is only a necessary but not a sufficient condition; decision-makers also need to be able to identify the most productive policies, organization processes and production techniques to put them to use. When a broad menu of new ideas become available *and* the "best" new ideas are identified and implemented by policy makers, entrepreneurs, firms and other economic actors, technological change results. Since technological change enhances economic growth, we further anticipate links between all three sub-components and GDP per capita growth rates, and an even stronger link between the aggregated empowerment concept and growth. We now turn to discussing the potential mechanisms, which we sort according to the three sub-components of WPE.

3.1. Descriptive political representation

The above-reviewed argument highlighting that excluding women – about half the population in all countries – from key positions in the labor market is economically inefficient (e.g., Esteve-Volart, 2004), can be translated to the area of political representation. Legislatures and executives (or local councils, for that matter) are arenas where many decisions with vital implications for the economy are made. If we assume that (a) economic and other policies matter for economic development e.g., through affecting the diffusion and selection of ideas, and (b) the quality of policies depends on characteristics of the decision makers, then changes in descriptive political representation should affect development. Phillips (1995), for example, highlights that personal characteristics of representatives are relevant for the representation of different groups' interests, with implications for policy-making. Given unequal representation, the adopted policies likely reflect the preconditions and preconceptions of the dominant group (Young, 2011).

Briefly summarized, we surmise that including women in politics expands the country's "political talent pool" and increases the variance in other relevant characteristics of representatives such as types of experience, knowledge, or even policy preferences (e.g., Khan, 2017). This increased variance, in turn, increases the likelihood of bringing in new and different ideas and enhances the quality of deliberation (Mansbridge, 1999), thereby increasing chances of adopting policies that benefit broader segments of the population. Improved descriptive representation of women may thus increase both the variation of policy ideas *and* improve the process of selecting the "best" such ideas, with downstream consequences for productivity in the various affected sectors.

Core assumptions in this argument finds backing from quite different studies: First, several studies show systematic differences in the policy preferences of women and men due to their distinct experiences, observed both at the citizen and elite levels (e.g., Khan, 2017; Sapiro, 1981; Clayton et al., 2019; Wängnerud, 2000;

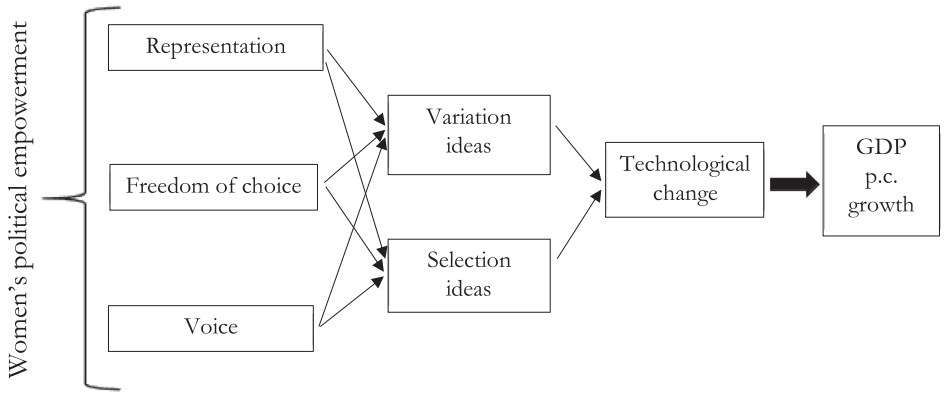

Fig. 1. Sketch of the main components and links in our argument.

Schwindt-Bayer, 2006). Given these differences, increased representation of women may lead to the selection of policies that are different and might be (objectively) better at generating certain development outcomes such as improved health-care and education, with downstream implications for growth in productivity and income. At the micro level, evidence from different contexts suggest that when women are empowered to take decisions, they invest more in goods and services that improve the well-being of families, further education and health-care (Duflo, 2012; Rink & Barros, 2021; Annan, Donald, Goldstein, Martinez, & Koolwal, 2021; Holland & Rammohan, 2019), and overall reduce households' financial vulnerability (Garikipati, 2008). At a more aggregate level, Miller (2008) demonstrates that introduction of suffrage for women in the United States was followed by declining infant mortality due to the qualitatively different issues women placed on the political agenda, notably related to health-care. Elite-level analysis reveal that women candidates present themselves in a systematically distinct manner from men in campaigns and online behavior, and more often promote health-care and education issues (Kahn, 1993; Evans & Clark, 2016; Mechkova & Wilson, 2021). Regarding policy output, Swiss, Fallon, and Burgos (2012) find that descriptive representation of women in parliament corresponds with increased rates of immunization and child survival. One explanation for this positive change is that women politicians invest more in public health-care compared to their male counterparts, as found at the local level in Brazil (Funk & Philips, 2018), and at the national level in sub-Saharan Africa (Mechkova & Carlitz, 2020) and globally (Clayton & Zetterberg, 2018). Likewise, Chattopadhyay and Duflo (2004) find that women elected as local leaders in India invest more in infrastructure prioritized by women, generally, such as clean drinking water sources. Women representation thus seems to systematically matter for public services provision and what economic policies are pursued, with potential downstream consequences for productivity growth also in the private sector.

Improved descriptive representation also has symbolic significance (Pitkin, 1967), which could, in turn, have substantive effects. Citizens more likely trust and engage with governments that they consider representative (Mansbridge, 1999). Women voters are more likely to contact women representatives (Mechkova & Carlitz, 2020) and women citizens more often attend village meetings and express their views with women in the local leadership (Beaman, Chattopadhyay, Duflo, Pande, & Topalova, 2009). Such feedback and interactions between citizens and policy makers are crucial for identifying what policies are appropriate for the local context and for effectively implementing them, with benevolent implications for technology adoption and productivity growth in the affected communities (Evans, 1995).

Finally, better political representation can enhance the participation of women in the economy. Ghani, Mani, and O'Connell (2013) examine mandated local-level representation in India and find that higher political representation of women over extended time relates to greater labor force participation by women. This stems partly from increased public sector employment and partly from the building of infrastructure (e.g., roads and health-care) that facilitates women entering the labor force. And, as proposed by Esteve-Volart (2004), increased labor force participation leads not only to a more heterogeneous pool of workers, but also to CEOs and other decision-makers in the economy, on average, being more talented, thereby enhancing technological change and, as a consequence, productivity growth.

3.2. Freedom of choice

Civil liberties include private and political liberties (e.g., freedoms of expression and movement), physical integrity rights (e.g., freedom from forced labor and torture), and property rights. Such liberties are differentially protected across countries, but also between groups within a country. Typically, women's liberties are worse protected than men's (e.g., World Bank, 2020b). Insofar as women constitute about half the population, arguments credibly linking the protection of civil liberties, more generally, to technological change and economic growth should be highly relevant for women's civil liberties, more specifically. We review two relevant such arguments.

One prominent "institutionalist explanation" of development focuses on institutions that ensure the protection of property rights (North, 1990; Acemoglu et al., 2001), a key civil liberty. Assessments of risks and expected profits hinge on investors' perception of whether their future rights to an investment object (and revenue generated from it) are protected from theft, expropriation, and other infringements. When protected, the expected returns to an investment object more likely outweigh expected costs, leading to more investments and thus higher income levels (Olson, 1993). More specifically, a well-functioning rule of law and stable property rights reduce various risks and expected costs for firms and other economic actors of investing in costly research and development-related activities (e.g., Romer, 1990). Whenever poor

property rights protection pertains to half the population (women), both investment and productivity growth should therefore decline.

Adding to the general argument, Goltz, Buche, and Pathak (2015) find an interaction effect between rule of law and women's descriptive representation on women's entrepreneurship. Reforms aimed at stimulating women's economic participation, enforced by female political representatives, are less effective when rule of law is weak. Yet, Goltz et al. (2015) consider rule of law at the country-level without accounting for women facing disproportionate infringements. Goldstein and Udry (2008) study Ghana, where women have less secure tenure rights than men. This hinders women from leaving their land for a long fallow, despite the clear productivity benefits of this practice when fertilizers are too expensive. The result is lower productivity on female-owned than male-owned plots; even within the same household, wives achieve significantly lower profits than husbands (p.995). Similarly, Duflo (2012) proposes relatively weaker property rights for women as an explanation for why households invest less in labor and fertilizers for plots owned by women, thereby hurting productivity in what remains the dominant sector in many economies.

The second argument focuses on private and political liberties – notably freedoms of speech, media, and movement – for increasing variation in new ideas and for selecting the more efficient ones. Estrin and Mickiewicz (2011) considers the economic consequences of gender-specific violations of such rights, and finds that violations on freedom of movement affect women disproportionately, with negative consequences for women's employment. In some patriarchal societies, women's freedom of movement are so severely restricted that they cannot leave their homes without their husbands' permission, leading also to various economic inefficiencies. Studying rural India, Imai et al. (2014) shows that restriction on movement for women is associated with child malnutrition. Concerning freedom of expression, Knutsen (2015) details how free speech and open debate enable entrepreneurs, decision-makers in firms, bureaucrats, and politicians to adopt and disseminate ideas from abroad and identify and discard less efficient solutions. Even when motivated by purely political reasons such as restricting anti-regime mobilization, limitations on communication and free speech unintentionally suppress also the diffusion of economically relevant ideas both in the bureaucracy and the business sector; in practice, enforcing restrictions on political speech without harming diffusion of economic ideas is difficult. Knutsen (2015) finds empirical evidence that civil liberties protection enhance technological change and, subsequently, economic growth. We thus expect that stronger protection of civil liberties for women, more specifically, enhances technological change and economic growth.

3.3. Voice

Finally, we consider the consequences of whether ordinary women can effectively voice their preferences and ideas through civic participation, be it through private political discussions, civil society, or the media. As summarized by Sundström et al. (2017), in order to be politically empowered, women must not only have the opportunity to freely express political views through civil liberties protection, but also the opportunity to organize collectively and be represented in key arenas of political debate such as the media and civil society.

We surmise that participation by women in different areas of social life facilitate both the diffusion and selection of new ideas. The rationale is that when women have an effective voice, the variety and quality of information and ideas that are received by decision-makers increase. Policies, and even major decisions in the private sector, are not formulated by political or business leaders in a vacuum, but are shaped through interaction with interest groups, experts, and the media. Weldon (2002), for instance, highlights how civil society mobilization shapes political change, and thus the more indirect, but important, influence that social groups can achieve by mobilizing outside of formal political institutions. Hence, if women can participate actively in civic movements, their ideas, preferences, and suggestions are more likely to shape policy and business decisions.[3]

More specifically, civil society organizations – due to their specialized knowledge and by voicing the preferences of relevant, interested parties – play a prominent role in providing inputs to the formulation and effective implementation of policies, either through lobbying, awareness raising, or institutionalized input mechanisms such as public hearings (Evans, 1995). Restricting women's ability to organize and actively partake in civil society thus restricts relevant feedback to decision-makers. The production of any public service benefits from the active participation and input of citizens, with positive implications for long-term development (Parks et al., 1981; Ostrom, 1996). In countries where civil society participation and information sharing between non-governmental organizations and the government is heavily regulated or even forbidden, fewer unconventional inputs and viewpoints are presented, making it harder for decision-makers to identify the full range of options or detect flaws in favored policies (North, 2005; Birnir & Waguespack, 2011). This may, in turn, adversely affect productivity-enhancing activities also in the private sector.

Societies with representation of diverse interests may also produce a more cooperative atmosphere, where minority groups are more likely to speak out to defend their interests and the dominant group more prepared to listen to different views (Kanter, 2008). Thus, in gender-inclusive organizations and societies, inputs and contributions from diverse groups may help policy makers with the two inherently difficult tasks of, first, selecting policies with potential macroeconomic benefits and, second, implementing them in a more efficient manner with less resistance and more cooperation from different concerned parties, including businesses (Evans, 1995).

4. Data and benchmark model specification

4.1. Independent variables

Until recently, data limitations on our independent variable would have hindered our ability to systematically test implications from the above argument on extensive data material. However, the recent V-Dem dataset (Coppedge et al., 2019) contains measures that have extensive coverage and match up well with the relevant dimensions of the theoretical concept of interest, namely gender-specific features of political representation, civil liberties, and civil society participation. Some V-Dem indicators pertain to more objective features of political systems (e.g., population share with de jure voting rights) and are coded by a few researchers or research assistants for all countries. Other indicators are more evaluative (e.g., extent of election violence) and assigned scores on the basis of expert surveys. Normally, at least five independent country experts score each indicator per country-year, totaling more than 3200 experts for the 202 countries. Experts vary by subject area and country, and are recruited based on documented expertise in the particular area. V-Dem combines the expert assessments by using a Bayesian item response measurement

[3] Kumar, Raghunathan, Arrieta, Jilani, and Pandey (2021) exemplify the relevance and beneficial effects of participating in civil society organizations. They show how women self-help groups in rural India, initially serving as savings and credit groups, later developed to raise awareness on health and nutrition, address gender- and caste-based discrimination, and, overall, influence governance at the local level.

model. This model takes into account each expert's reliability – determined, inter alia, by level of agreement with other experts – and leverages several pieces of information (e.g., anchoring vignettes and cross-country coding) to ensure comparability across countries and over time (for details, see Pemstein et al., 2018; Coppedge et al., 2020).

We use V-Dem's Women Political Empowerment index (WPE) to measure our main independent variable. WPE consists of three sub-indices, which are equally weighted through taking a simple average (reflecting that the three components are partial substitutes in enhancing the wider concept; see Goertz (2006)). The first sub-index, *Women's civil liberties*, largely captures our theoretical freedom of choice sub-component and is formed by Bayesian factor analysis on four expert-coded items. The second sub-index is *Women's civil society participation*, which roughly corresponds to the theorized voice sub-component and is formed by Bayesian factor analysis on three expert-coded items. The final sub-index is *Women's political participation*, which taps into the representation sub-component and is constructed by averaging two indicators. Table 1 lists all indicators included in each sub-index. The aggregated WPE ranges from 0–1 (high empowerment). We present descriptive statistics and map distributions of WPE and the other main variables in the Appendix.

Table 1
Components and indicators entering V-Dem's Women Political Empowerment Index

Women Political Empowerment Index	
Women civil liberties index	Freedom of domestic movement women
	Freedom from forced labor women
	Property rights women
	Access to justice women
Women civil society participation index	Freedom of discussion women
	CSO women's participation
	Percent female journalists
Women political participation index	Power distributed by gender
	Lower chamber female legislators

4.2. Dependent variables

Our first dependent variable is GDP per capita growth, measured in annualized, percentage terms. We mainly draw on Ln GDP per capita estimates from Fariss et al. (2017), but also run tests using GDP data from the Maddison project (Bolt & Jutta, 2014). The former data source allows us to extend the analysis back to 1789 and include 182 polities in our benchmark, whereas the latter extends back to 1800 and allows us to include 163 polities. Fariss et al. obtain GDP estimates by using a dynamic latent trait model and drawing on information from various GDP and population datasets, including the Maddison data.[4] Importantly, Fariss et al.'s latent model estimation routine mitigates various kinds of measurement error as well as missing values by imputation. When using the original Maddison data – which are often measured every tenth year in the 1800s – we interpolate time series by assuming constant growth rates across intervals with missing data. Since the Fariss et al. time series are imputed, and predictions are presumably poorer for observations without scores even on the extensive Maddison series, many error-prone observations are likely dropped when we use the original Maddison series. In sum, the two GDP sources have different validity and reliability issues, but should complement each other well.

Our second dependent variable pertains to technological change. Researchers have tried to capture technological change with several indices and proxies (see, e.g., Knutsen, 2015), but most measures lack extensive time series or cross-country coverage. The most commonly used proxy among growth economists is growth in Total Factor Productivity (TFP). TFP growth is basically calculated as residual economic growth after removing growth stemming from changes in physical capital, human capital, and labor supply. This measure fits well with the broad technology concept outlined above, as it captures productivity changes stemming from different changes to how inputs are combined into producing output, regardless of whether this change comes from domestic innovations or adoption of foreign ideas pertaining to organization or production processes. Since TFP is calculated as a residual, TFP growth can also stem from other processes than technological change that are left unaccounted for in the growth accounting exercise, such as price increases for major exports and natural resource discoveries. Yet, technological change is widely considered to be the main source behind TFP growth (see, e.g., Helpman, 2004). Since growth stemming from labor hours and human capital is subtracted in the growth accounting procedure, tests on TFP growth is especially relevant for accounting for other very plausible explanations of why WPE enhances economic growth, notably related to increased female labor force participation and school enrollment. These alternative channels may very well operate simultaneously as our theorized channel pertaining to technological change, and contribute to the overall correlation between WPE and economic growth. By using TFP growth as an outcome, we aim to isolate the latter channel.

We use the extensive TFP data from Baier et al. (2006), which cover 145 countries with several time series extending back to the 19th century – the earliest measurement is the United Kingdom in 1831. Baier et al. (2006) draw on various sources to produce their growth accounting estimates, notably the Penn World Tables, World Development Indicators, Maddison, and Mitchell's historical statistics (for details, see Baier et al. (2002) pp. 24–26). Yet, given the paucity of relevant historical data, Baier et al. only calculate TFP with uneven intervals, and with years of measurement differing across countries.[5] Typically, time series include a data point about every tenth year. We therefore follow the approach in Knutsen (2015) and interpolate time series by assuming constant annual TFP growth rates between two observations. The induced measurement error – truncating variation in TFP growth by assuming it is constant within periods – means that it is inherently hard to obtain clear results even when the relationship is moderately strong.

Adding to the difficulty of obtaining clear results, is the fact that economic development and (especially) WPE are slow-moving variables. Attitudes towards gender equality may be driven by social norms that take a generation or more to alter substantially, and norm change must subsequently be followed by changes to sluggish institutions to influence WPE. We thus require long time series. Extending the time series across modern history also allows us to capture more relevant changes and increase statistical power for another (but related) reason. Women have obtained civil and political rights and become substantially involved in the public sphere at very different points in time in different countries. For example, Saudi Arabia lifted restrictions on movement for women in 2017, although women still do not have equal property rights as men (World Bank, 2020b). In contrast, in the UK, women's property

[4] The Fariss et al. estimates we use are benchmarked in the Maddison time series.

[5] The paucity of historical data is, naturally, related to fewer high-quality sources and attempts by governments and other organizations at systematic measurement during periods when the GDP accounting system was not even invented. Hence, data quality, and the resulting validity and reliability of both the GDP and TFP measures, is also typically lower early in our time series for the observations that do have data. If measurement errors in the outcome variables are mainly unsystematic, this should increase standard errors but not bias results. This makes it harder to find statistically significant results for sub-samples with early observations than for equivalently sized sub-samples with more recent observations.

rights developed over centuries, but one milestone was the Married Women's Property Acts of 1879 and 1882. These acts recognized husbands and wives as separate legal entities, allowing wives to own, buy, and sell property (Griffin, 2003). Hence, using extensive samples and time series is vital for capturing relevant changes in very different contexts and, more generally, having sufficient statistical power to properly test implications from our argument.

4.3. Benchmark specification and controls

We try out different estimators and model specifications, but employ Ordinary Least Squares (OLS) for our benchmark specification. We always cluster errors by country to account for panel-level autocorrelation. We start by analyzing country-years as units to capture as much information as possible and maximize efficiency. We also try out 5- and 10-year panels, which have the benefits of smoothing out measurement errors and further mitigating autocorrelation. The theoretical discussion suggested that substantial time may pass before the hypothesized effect from WPE is transmitted – via public policies and, in turn, their impact on the behavior of firms and other economic agents – to technological change and observed growth rates. Yet, the exact lag-time is hard to theorize. While we assume a 5-year lag in our benchmark, we thus also test specifications measuring growth closer in time to or further away from the covariates.

Regarding control variables, natural resource endowments, geographical features, political-historical legacies, persistent social norms, and other country-specific factors could enhance (or depress) both WPE and growth. There may be several such hard-to-observe factors explaining why, say, Denmark has consistently higher WPE scores and growth rates than, say, Afghanistan. We therefore want to avoid drawing inferences from cross-country comparisons. Additionally, confounding may come from time-specific factors; certain decades of modern history may have given birth to ideological or technological trends that boosted women empowerment *and* growth. Therefore, our benchmark includes both country- and year-fixed effects.

Concerning other time-varying controls, we intentionally keep our benchmark specification sparse to minimize missing due to listwise deletion and, more importantly, mitigate post-treatment bias. The latter concern pertains to the possibility that variables such as production structure of the economy or state capacity may be affected by WPE. Take, for example, labor force participation by women, which the reviewed literature suggests is relevant for growth. In addition to being measured with relatively short time series, we explicitly theorize that the political empowerment of women enhances growth, in part, because it enhances women's labor force participation. Controlling for such mediating factors could "block off" relevant indirect effects that we want to include in our estimated, overall relationship.

Hence, we only include initial Ln GDP per capita in the GDP per capita growth regressions and initial Ln TFP in the TFP growth regressions. These are important controls; richer and technologically more advanced countries – due to conditional convergence mechanisms (Barro & Martin, 2004) – often have slower current growth rates. Insofar as accumulated level of development or technological advancement of the economy also influences women's political empowerment, accounting for these variables is vital for mitigating endogeneity biases. We expand on of how technological differences may affect WPE and strategies for reducing the accompanying endogeneity biased in the penultimate section. In alternative specifications, we add other covariates that may – despite introducing post-treatment bias – also act as confounders, including short- and medium term trends in growth rates, natural resource dependence, urbanization, agricultural production, land inequality, population size, history of independent statehood, political instability, interstate war, civil war, and state capacity.

One such (questionable) extra control is democracy, which may both causally affect WPE (e.g., Sung, 2012) and be influenced by it. To exemplify the latter relationship, women's civil society activism was key in democratization efforts in, e.g., South Africa, Chile, and Morocco (Wang et al., 2017) Indeed, even the conceptual boundaries are unclear, as both concepts include similar aspects of political participation and protection of rights. Even at the deeper level of core principles, the concepts are hard to fully separate – empowering women politically is required for ensuring "rule by the people" or "popular control over decision-making under conditions of political equality among citizens". Achieving a high-quality democracy, according to the latter definitions, is impossible if WPE is low.

Despite this conceptual overlap, there are important theoretical and empirical distinctions between (most notions of) democracy and women's political empowerment, especially if we consider narrow, electoral definitions of democracy that do not require extensive protection of various minority rights or widespread civil society participation (see Coppedge et al., 2020). Contested multiparty elections are possible to achieve even absent WPE. Concerning representation, in 2019 women comprised only 24.5% of parliamentarians worldwide and were severely under-represented also in many "high-quality democracies"; and, the two top-performing countries, Sweden and Rwanda, occupy opposite ends of the democracy spectrum. While democracies are generally better at protecting civil liberties for women, several autocracies advance women's rights, albeit often for strategic purposes (Donno & Kreft, 2019). Finally, there is great variance in civil society activity and women's participation in democracies and autocracies alike. Appendix Fig. A.2 visualizes these complex empirical patterns, plotting WPE and its sub-components against V-Dem's measure of electoral democracy (the Polyarchy index; Teorell, Coppedge, Lindberg, & Skaaning, 2019). Given the intricate relationship between WPE and democracy, we test models excluding democracy and models including democracy, but where we then rely on narrow, electoral measures of democracy to minimize overlap.

5. Empirical analysis

We first assess the empirical implication that WPE enhances economic growth. Next, we detail this relationship by considering whether it applies to different geographical and temporal contexts, before testing whether all three sub-components of WPE relate to growth, as anticipated by our argument. Finally, we investigate the relationship between WPE and TFP growth.

5.1. Main analysis: Women's political empowerment and economic growth

We start by considering descriptive statistics and cross-country correlations. The scatterplots in Figs. 2 (Maddison GDP data) and 3 (Fariss et al. GDP data) illustrate the positive cross-country correlation that has existed – and has been fairly persistent through modern history – between WPE and Ln GDP per capita for the years 1830, 1900, 1950, and 2000. Also for (annual) GDP per capita growth rates, there are clear differences between countries with low and high WPE scores. When dividing the 21,853 observations into quartiles on WPE – with 0.172 marking the cut-off for the lowest quartile, 0.344 the median, and 0.611 the highest quartile – we find that average growth rates, for the Fariss et al. data, increase monotonically and quite substantially with WPE quartiles. The lowest quartile has an average growth rate of 0.2 percent, and the second quartile grows, on average, at 0.6 percent. In contrast,

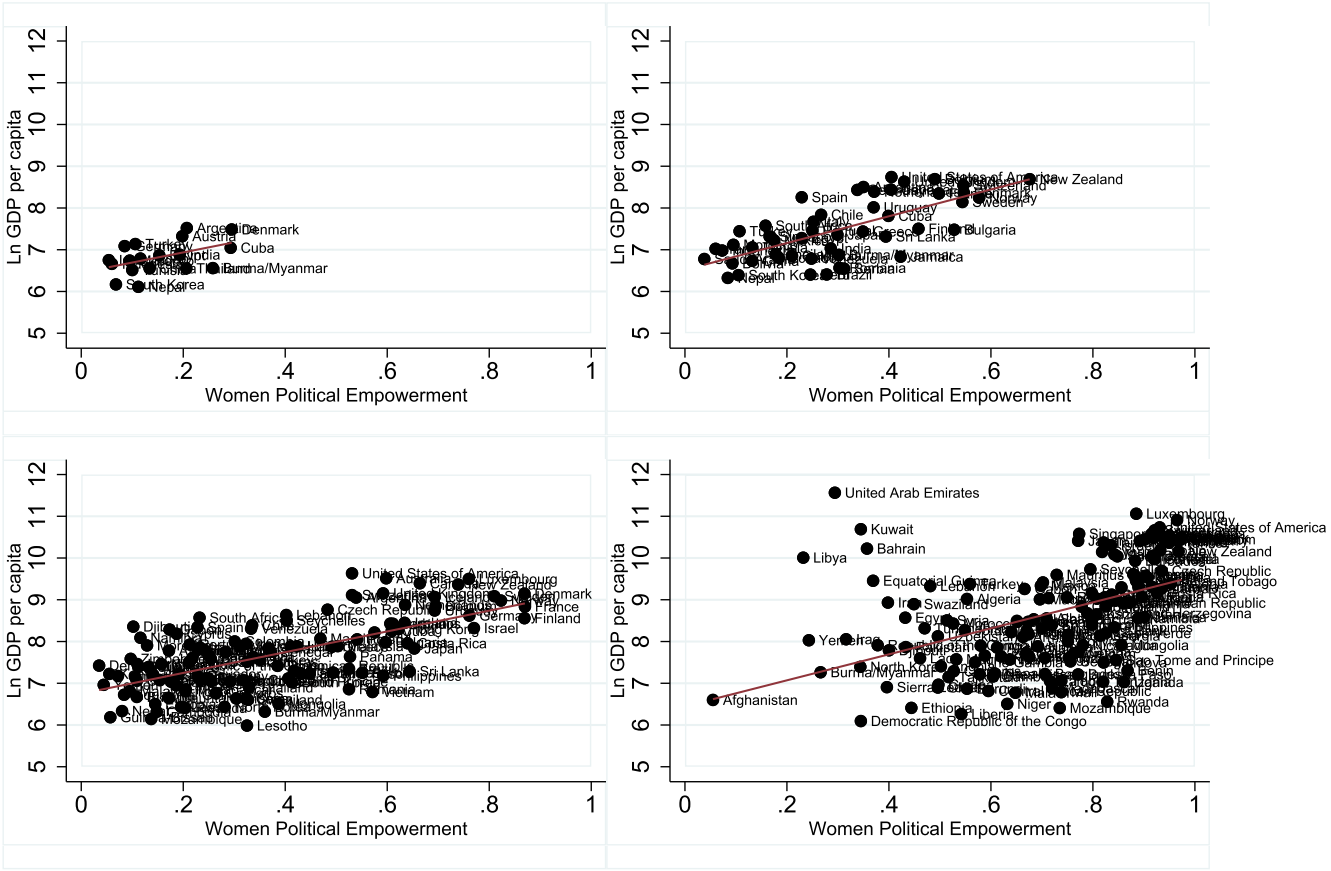

Fig. 2. Scatter-plots, overlaid with (bivariate) best-fit lines for WPE (x-axes) and Ln GDP per capita(data taken from the Maddison project; y-axes) in 1830 (top-left), 1900 (top-right), 1950 (bottom-left), and 2000 (bottom-right).

the third and fourth quartiles exhibits average growth of 1.5 and 2.7 percent, respectively. When using Maddison data (Bolt & Jutta, 2014), with numerous missing observations especially among colonies and 19th century countries, the corresponding growth rates are, respectively, 1.2, 1.2, 2.0, and 2.9. Countries where women are politically empowered display much higher economic growth, on average. Yet, the strong, positive correlation may stem from various sources, including the reverse causal relationship or that different (observable or unobservable) confounders systematically affect both WPE and growth. To reduce such concerns – although we remind that they can never be entirely removed with the available observational data – we turn to our panel regressions.

Model 1.1 in Table 2 is the benchmark OLS specification on growth with country-year as unit of analysis, errors clustered by country, and using GDP data from Fariss et al. (2017). The controls include initial Ln GDP per capita and country- and year-fixed effects. The dependent variable is the annual percentage change in GDP per capita five years after covariates are measured, i.e., the growth rate in $t+5$. The model draws on 15,879 observations from 182 countries, with maximum time series extending across 221 years. As expected, we find a positive relationship between WPE and growth, which is statistically significant at the 1% level. The point estimate indicates that going from the first quartile score on WPE (.20; e.g., Italy under Mussolini in the 1930s) to the third quartile score (.61; Australia, 1950s) increases annual GDP per capita growth with about 0.9 percentage points. The long-term consequences of such a growth differential are substantial. Consider two countries, *A* and *B*, that start out with identical GDP per capita levels and where A starts growing at a 0.9 percentage point higher rate. After 10 years, *A*'s GDP per capita is about 9 percentage points higher than B's. After 40 years, the difference has increased to 43 percent. For an even larger change in WPE, going from the 10th percentile (.11; The Two Siciles, 1820s or Sudan, 1920s) to the 90th (.82; Canada, 1970s), the GDP per capita differences are about 16 percent after 10 years and 84 percent after 40 years. As shown by the equivalent Model 1.2, results are similar when using the Maddison GDP data. If these estimates are fairly accurate, improving women's political empowerment has substantial consequences for long-term development.

One alternative way of specifying growth models, is to use forward-lagged Ln GDP per capita level as the dependent variable.[6] Since annual growth is very volatile, this alternative specification is less affected by measurement errors and business cycle fluctuations. Further, employing forward-lagged Ln GDP p.c. in, say, $t+5$ instead of GDP per capita growth from $t+4$ to $t+5$ allows us to also include any short-term effects that might exist, since we capture changes in income across the entire period from t to $t+5$. The downside is that this specification magnifies autocorrelation problems and that it models conditional convergence dynamics less well – growth is no longer a linear function of past income levels. Given the pros and cons of the different specifications, we tested both versions. Models 1.3 and 1.4 replicate Models 1.1 and 1.2, respectively, but with Ln GDP per capita in $t+5$ as dependent variable. WPE remains robust.

We noted how using Ln GDP per capita as dependent variable magnifies autocorrelation issues, which may influence results even if we cluster errors by country. To mitigate this issue, we followed another conventional approach in growth economics and re-estimated Models 1.3 and 1.4 on 5-year panels. When measuring the dependent variable with 5-year intervals, there is weaker cor-

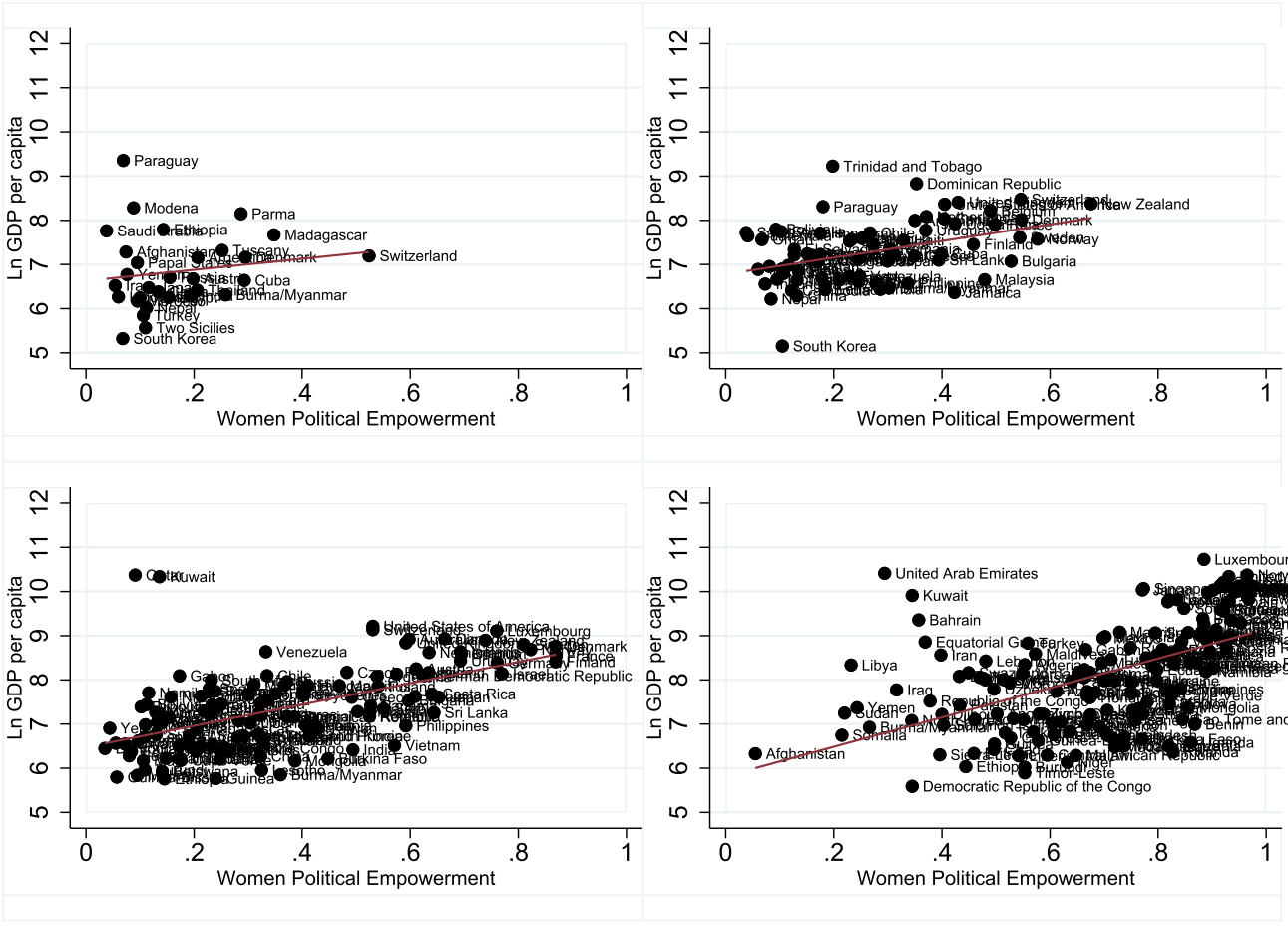

Fig. 3. Scatter-plots, overlaid with (bivariate) best-fit lines for WPE (x-axes) and Ln GDP per capita(data taken from Farris 2017; y-axes) in 1830 (top-left), 1900 (top-right), 1950 (bottom-left), and 2000 (bottom-right).

Table 2
Main analysis: Fixed effects OLS regressions on GDP per capita growth or Ln GDP p.c. measured in $t + 5$.

	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)
	DV: GDP p.c. growth in year t + 5		DV: Ln GDP p.c. in year t + 5			
Panel length	1 yr	1 yr	1 yr	1 yr	5 yrs	5yrs
GDP data source	Fariss	Maddison	Fariss	Maddison	Fariss	Maddison
	b/(t)	b/(t)	b/(t)	b/(t)	b/(t)	b/(t)
Women pol. empowerment	2.158***	2.231**	0.110***	0.119***	0.148***	0.118**
	(2.719)	(2.329)	(2.763)	(2.610)	(2.850)	(2.407)
Ln GDP per capita	−1.237***	−2.551***	0.937***	0.892***	0.922***	0.888***
	(−5.101)	(−8.322)	(64.898)	(64.555)	(44.452)	(63.160)
Country dummies	Y	Y	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y	Y	Y
N	15879	13391	15880	13391	3154	2762
Countries	182	163	182	163	180	162
Max time series	221	215	221	215	44	44
R^2	0.029	0.085	0.945	0.949	0.933	0.947

Notes: ∗p<0.1; ∗∗p<0.05; ∗ ∗ ∗p<0.01. Errors are clustered by country. Covariates are measured 5 years before DV.

relation with past realizations of the outcome than for 1-year intervals. Results are reported in Models 1.6 and 1.7, and once again WPE is robust.

In sum, neither source of GDP data, dependent variable specification, nor choice of panel structure affects the main result; there is a clear and sizable positive relationship between women's political empowerment and subsequent economic growth.

5.2. Robustness tests

The Appendix contains several additional robustness tests, but we present a selection of important ones using the Fariss et al. GDP data in Table 3. Appendix Table A.2 shows equivalent tests for Maddison data; results are fairly consistent when using these data with fewer observations. Model 2.1, Table 3 is equivalent to

Table 3
Selected robustness tests.

	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)	(2.8)	(2.9)	(2.10)	(2.11)	(2.12)	(2.13)	(2.14)
	1-year panels; DV: GDP p.c. growth									5-year panels; DV: Ln GDP p.c.				
DV measured in	$t+5$ b/(t)	$t+1$ b/(t)	$t+3$ b/(t)	$t+10$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+10$ b/(t)	$t+5$ b/(t)	$t+5$	$t+5$
Women pol. emp.	2.158***	3.785***	1.810**	1.968**	2.629**	2.172**	1.453	2.141***	2.495*	0.148***	0.285***	0.156***	0.290**	0.316**
	(2.719)	(3.335)	(2.306)	(2.025)	(2.567)	(2.434)	(1.351)	(2.715)	(1.937)	(2.850)	(3.113)	(3.053)	(1.997)	(2.249)
Ln GDP p.c.	−1.237***	−2.402***	−0.967***	−1.484***	−1.291***	−1.239***	−1.637***	−1.197***	−1.798***	0.922***	0.851***	1.034***	0.998***	1.132***
	(−5.101)	(−4.044)	(−4.328)	(−5.074)	(−4.998)	(−4.909)	(−6.058)	(−5.134)	(−5.696)	(44.452)	(24.460)	(10.290)	(54.292)	(5.457)
Polyarchy					−0.579				−0.824					
					(−0.817)				(−0.943)					
Imp. public adm.						−0.001			−0.063					
						(−0.012)			(−0.438)					
Resource dep.							−0.038**		−0.038**					
							(−2.209)		(−2.178)					
Ln population								0.241	−0.306					
								(1.041)	(−1.096)					
Ln GDP p.c. $t-5$												−0.103		−0.142
												(−1.050)		(−0.675)
Ln GDP p.c. $t-10$												−0.005		
												(−0.183)		
Ln GDP p.c. $t-15$												0.004		
												(0.196)		
Country dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	15879	16645	16256	14947	15552	15857	10716	15879	10510	3154	2970	2698	3154	3001
R^2	0.029	0.035	0.027	0.031	0.029	0.028	0.135	0.029	0.139	0.933	0.876	0.950		
Instruments													126	126
Hansen J-test													.53	.67
Ar(2)													.38	.53
AR(3)													.11	.45

Notes: *p<0.1; **p<0.05; * * *p<0.01. Errors are clustered by country.
GDP data are from Fariss et al. (2017). Models 1–12 are estimated by OLS and Models 13–14 by System GMM.

Model 1.1 from Table 2, with growth in $t+5$ as dependent variable. This model is included to ease comparisons with alternative specifications.

First, we investigate whether WPE is sensitive to choice of lag-structure (see also Fig. 4). Model 2.2 measures growth only one year after the covariates. WPE remains highly significant ($t = 3.3$), and the coefficient actually increases in size, suggesting a strong boost in short-term growth from improved women empowerment. While standard considerations pertaining to statistical uncertainty should caution against over-interpreting a single such coefficient, this finding may seem surprising, given the theoretical discussion on the expected time it takes for changes in political features to translate into technological change. Yet, our argument on WPE and technological change does not preclude alternative – or rather additional – mechanisms also linking WPE to economic growth through enhanced factor inputs, such as increased labor force participation for women. Indeed, similar tests presented below for TFP growth do not show a similar short-term boost. But, even more importantly for assessing our argument, tests both on GDP per capita and TFP growth suggest sizeable longer-term gains, and these results are quite stable to using alternative lag-lengths and other specification choices.

Still, the short-term result raises concerns that WPE might correlate with growth due to other causal patterns – notably reverse causality – than the theorized effect. We thus tested whether WPE is correlated with contemporaneous growth, and it is not; WPE is statistically insignificant and even flips sign (see Fig. 4). Moreover, WPE is unrelated to growth when the latter is measured before the former. We tested both 1-, 3-, 5- and 10-year lags on growth and neither are systematically correlated with current WPE; t-values vary between −0.4 and +0.7 and coefficients are small in magnitude. We will return to alternative specifications that deal with endogeneity concerns related to past trends in growth; in brief, we do not find evidence that such patterns confound the relationship. Although we cannot exclude the possibility of endogeneity bias, despite our best efforts, we believe that the most plausible interpretation of the result in Model 2.2 is, in fact, that there exists a short-term effect of WPE on growth. This, we believe, comes in addition to the (theoretically less surprising) medium-term relationship captured by our benchmark.

As Models 2.3 (growth measured in $t+3$) and 2.4 (growth measured in $t+10$) show, the relationship is also robust to assuming alternative intermediate and longer-term effect lags. The WPE coefficient remains statistically significant at 5% and sizeable, albeit slightly attenuated relative to the benchmark.

We discussed how controlling for democracy level may lead to post-treatment bias, which is why we exclude democracy from the benchmark. However, we also discussed the partial conceptual overlap and plausible effects running from democratic institutions and rights, more generally, to WPE (Sung, 2012). Since democracy may enhance growth as well (e.g., Acemoglu, Naidu, Restrepo, & Robinson, 2019), omitting democracy could lead to (upward) omitted variable bias for WPE. Model 2.5 addresses this concern by adding V-Dem's Polyarchy index of electoral democracy to the benchmark. Polyarchy includes indicators on freedom of expression and media, and thus partly overlaps with WPE. We therefore also ran tests controlling for an even narrower measure only considering contested elections and male suffrage (results are similar; Appendix Table A.4). Yet, using Polyarchy has the additional benefit of accounting for potential subjective coder biases in the V-Dem data. For example, country-experts *could* evaluate fast-growing economies in an artificially positive manner on different political indicators, including those making up Polyarchy and WPE. Controlling for Polyarchy should thus purge the WPE coefficient of such a bias, if it exists. WPE remains significant at 5% and actually increases somewhat in size, from 2.1 to 2.6, when adding Polyarchy. Likewise, WPE retains a value of 2.2 and is significant at 5% in Model 2.6, which controls for a proxy of state capacity, V-Dem's indicator on impartial and rule-following public administration.

Model 2.7 adds a measure of natural resource dependence ($\frac{oil+gas+coal+mineralsrevenue}{GDP}$) from Miller (2015) to the benchmark. While WPE remains sizeable (1.5), it is statistically insignificant at conventional levels ($t = 1.4$). However, further analysis shows that much of the attenuation comes from the changing sample; missing data on resource dependence truncates the sample from 15,879 to

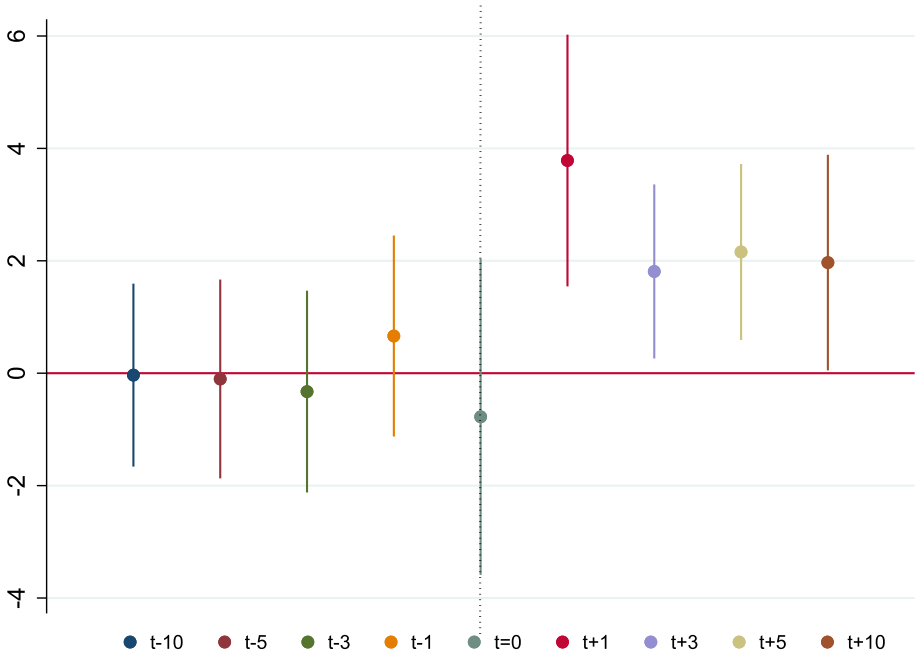

Fig. 4. Benchmark OLS Model (similar to 1.1, Table 2), but with GDP p.c. growth measured with various leads and lags relative to Women Political Empowerment. When lag structure is indicated as $t-x$ [$t+x$], outcome is measured before [after] covariates.

10,716 observations. When re-running the benchmark (Model 2.1) on this reduced sample, the WPE point-estimate is 1.8 and the t-value is 1.6. In Model 2.8, which controls for Ln population and where the sample is again 15,879 observations, WPE retains the size and significance from the benchmark. In the "kitchen-sink" specification (Model 2.9), which simultaneously controls for Polyarchy, impartial administration, resource dependence and population, WPE is actually higher than in the benchmark (2.5) with a t-value of 1.9. In Appendix Table A.5, we control for several other potential confounders that could affect both women's political empowerment and growth. These include agriculture as share of total production, land inequality, urbanization, years since independent statehood, recent history of civil war, recent history of interstate war, and political instability (number of regime-ending revolutions, insurgencies or coups the last decade). The WPE coefficient is quite stable in size, despite being attenuated somewhat due to the sample composition in some specifications, and WPE is always significant at least at the 10% level.

We conducted similar tests for 5-year panel specifications using Ln GDP per capita as dependent variable. Model 2.10 replicates Model 1.5 from Table 2. Model 2.11 maintains the 5-year panel set-up, but measures the outcome ten years (i.e., two panel periods) rather than five years after the covariates. This change strengthens the relationship quite substantially, increasing WPE from 0.15 to 0.28. This change was to be expected; with income being measured at the end of a 10-year period, we capture *both* the shorter- and medium-term effects of a change in WPE.

In Model 2.12, we tested for the potential endogeneity to prior trends in growth by including three additional lags of the dependent variable ($t-5, t-10$, and $t-15$, in addition to Ln GDP p.c. in t; the dependent variable is measured in $t+5$). By doing so, we follow Acemoglu et al. (2019) and account for pre-treatment patterns in income growth. The WPE coefficient and t-value increase somewhat when doing so. There are thus no clear empirical indications that historical trends in income growth confound the observed relationship between WPE and subsequently measured growth. In Appendix Table A.6, we also show specifications that include *country-specific time trends*, which should further guard against the possibility that some countries are on particular trajectories of development that simultaneously influence changes in WPE and GDP. While not entirely robust, most specifications show a substantial and highly significant WPE coefficient, even when accounting for country- and year-fixed effects alongside country-specific trends.

To further account for reverse causality and other potential sources of endogeneity in WPE, we ran System Generalized Method of Moments (GMM) models. These models are attuned to estimating relationships involving slow-moving variables such as WPE (see Blundell & Richard, 1998). In System GMM, lags of differences in variables are used to instrument for current levels, and, likewise, lags of levels are used to instrument for current differences. The specifications reported in Table 3 model only WPE as endogenous and use the second and third lags for instrumentation (to keep the instrument count below the number of cross-section units; see Roodman (2009)), whereas Appendix Table A.7 reports alternative specifications.[7] Model 2.13 includes only the first lag of the dependent variable as regressor, and 2.14 includes the first and second lags. Both specifications report a statistically significant WPE coefficient that is substantially higher than in the OLS models. While the Ar(2)-test in Model 2.13 suggests that residual autocorrelation might affect results, the specification tests for Model 2.14 more clearly indicate that this model yields a consistent estimate of the effect of WPE on growth. In sum, there is evidence, from different panel regressions, suggesting that improvements to the political empowerment of women enhances subsequent economic growth.

We also estimate the short and long-term effects of WPE on growth by using error correction models (ECMs) (De Boef & Keele, 2008). As explained by De Boef and Keele (2008), ECMs estimate "the rate at which Y_t changes to return to equilibrium after a change in X_t" (p.189), and are designed to separate the short-run from long-run effects (introducing, e.g., a so-called long-run multiplier). Appendix Table A.8 reports four ECM models with differenced (Δ) log GDP per capita as outcomes. Two models – both with and without Polyarchy as an additional control – use the country-year set-up with one-year lags (following De Boef & Keele (2008)), and the other two apply five-year panels with a five-year lag. The estimated long-term effects are consistently positive and highly significant, while only one estimated short-term effect is significant at 10%. Also the implied differences in the size of the short- and long-term effects are substantial. According to the 1-year lag parsimonious model, the short-run effect of WPE on GDP per capita is only about 7 percent of the magnitude of the long-run effect, and the latter is substantial; going from 0 to 1 on WPE is estimated to increase Ln GDP p.c. by 2.05, or about two standard deviations in our sample. In sum, the ECM results suggest that the political empowerment of women is associated substantially increased levels of economic development in the long run.

5.3. Assessing potential heterogeneity in the relationship

We assessed whether the relationship between WPE and economic growth is fairly consistent across time periods, geographical contexts, and regime types, or if it is much stronger in some settings than in others. For these tests on heterogeneity, our theoretical argument does not give clear *a priori* expectations on how the strength of the relationship should vary. First and foremost, we expect it to be consistently positive. The mechanisms proposed in our argument should not be restricted to a particular region, historical period, or regime type – women's political empowerment should enhance the variation in new ideas and the selection of more efficient ones regardless. That being said, both the nature of women's participation and protection of rights as well as the nature of technology differ across time periods, and it could well be that certain factors such as the wider political environment and production structure of the economy moderate the general relationship. So, there is good reason to anticipate some heterogeneity, despite the general nature of the argument and us not presenting (nor having) any clear *a priori*expectations on the differences in the size of the relationship across contexts. As a final caveat, we highlight that – especially when limiting the sample of observations – we are inevitably bound to observe some fluctuations in the WPE coefficient. These are relationships estimated with considerable uncertainty, and estimates for smaller samples are even more prone to vary across reasonable specifications. Hence, we caution against too readily interpreting even moderate differences in coefficients across sub-samples as theoretically meaningful information.

We estimated different tests to assess potential heterogeneity (see Appendix Table A.9 for interaction model tests). Fig. 5 (top panel) presents regression coefficients on WPE with 95% confidence intervals from straightforward split-sample tests, with the benchmark Model 1.1. estimated on limited samples. The leftmost coefficients pertain to pre- and post-WWII samples, respectively. The two middle coefficients pertain to "Western" (Western Europe, Canada, United States, Australia, New Zealand) and all other

[7] The instrument count also depends on the number of panel units, which makes the country-year set-up intractable.

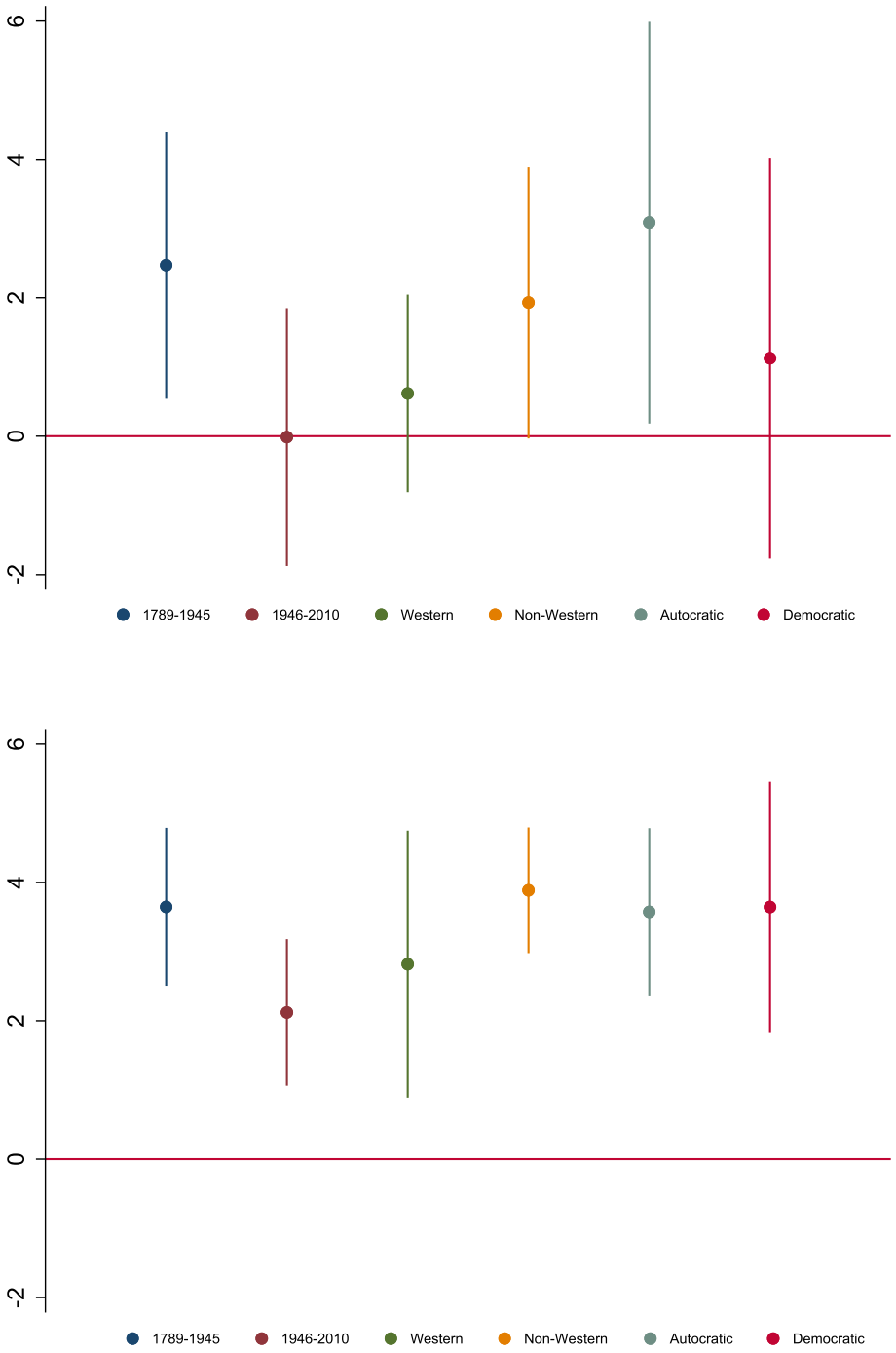

Fig. 5. Coefficient plots with 95% confidence intervals for Women Political Empowerment Index on limited samples, restricted by time period, geography, or regime type. Top panel: Coefficients are from equivalents to benchmark Model 1.1, Table 2. Bottom panel: Corresponding coefficients for specifications that omit country- and year-fixed effects, but are otherwise similar to Model 1.1., Table 2.

countries. Finally, the two rightmost coefficients pertain to democracies and autocracies, where we require competitive elections and universal suffrage for coding a regime as democratic (using the LIED measure by Skaaning, Gerring, & Bartusevičius (2015)). Interestingly, results indicate a somewhat stronger and clearer relationship in autocratic contexts. Technological change is, overall, slower in autocracies, due to various restrictions to free idea exchange and civil liberties that facilitate technology transfer (Knutsen, 2015). Hence, one could speculate that the observed pattern reflects that democracy and WPE act as substitutes, where empowering women is all the more important for technological change, and thus growth, when other institutional pre-conditions are absent.[8] However, other tests, including similar split sample tests on WPE and TFP growth (Appendix Fig. A.6), do not find evidence supporting this interpretation.

Further, the estimated relationship is stronger for the pre-WWII era than the period from 1946 and onwards, and the relationship is

[8] Since WPE is lower, on average, in autocracies, the split-sample results could reflect a concave relationship, where the marginal effect of WPE declines as WPE increases. However, we found no evidence of non-linearities when running our different specifications and adding a squared WPE term.

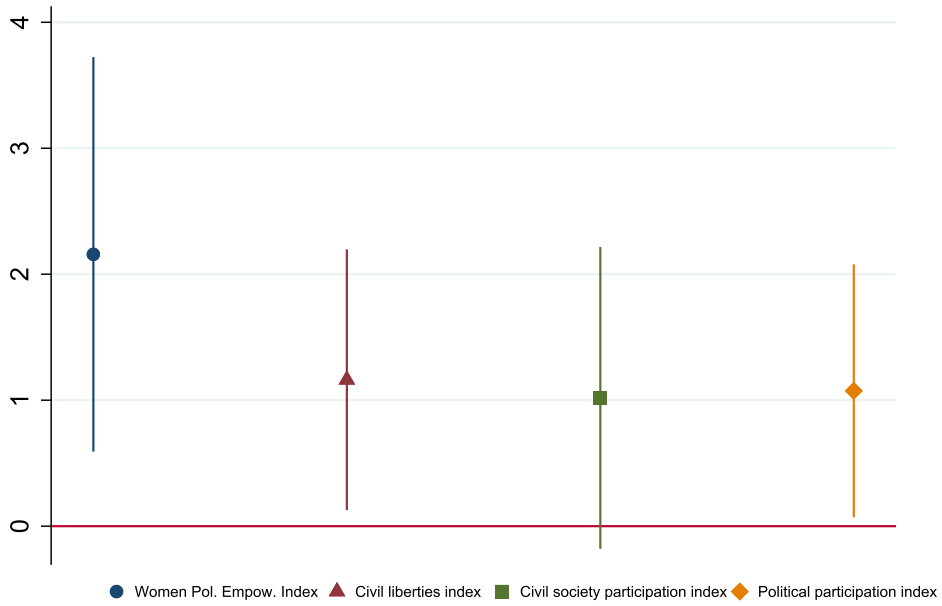

Fig. 6. Coefficient plots with 95% confidence intervals for Women Political Empowerment Index and its three sub-indices. All coefficients are from equivalents to the benchmark Model 1.1, Table 2, with annual GDP per capita growth in $t+5$ as dependent variable. All indices range from 0–1.

present and clear in "non-Western" countries, but not in "Western" countries. When further assessing spatial and temporal heterogeneity by re-running the benchmark on samples that, respectively, exclude particular geographical regions (e.g., Sub-Saharan Africa or Asia) and restrict the time series to a century (e.g., 1790–1889 or 1910–2009) we find that WPE is fairly stable in size and significance (Appendix Figs. A.3 and A.4).

We highlight, however, that the split sample results based on fewer units or shorter time series are sensitive to specification choices. The nature of the relationship under study (WPE is typically slow-moving) and data at hand (both the independent and dependent variables are measured with error) suggest that a large number of observations is needed to obtain fairly precise estimates, and coefficients may vary substantially in smaller samples. For instance, when omitting country-fixed effects, the relationship is large and highly significant also across the 31 included Western countries (as well as the 151 non-Western ones). And, when omitting year-fixed effects the relationship is large and significant both in the pre-WWII and post-WWII samples. The bottom panel of Fig. 5 shows fairly similar results when omitting both the country-and year-fixed effects simultaneously. In this specification, the estimated relationship is also virtually similar (and highly significant) for both regime types. While we do not put too much trust in the latter estimates, with omitted variables biases affecting results, they illustrate the sensitive nature of the split-sample results.

Next, we assessed whether the finding for the composite WPE is driven by one particular sub-component. The aggregated index consists of three sub-indices – on civil liberties, political participation, and civil society participation – capturing distinct aspects of women empowerment. Our theoretical argument implies that all three aspects should enhance technological change, and thus growth.

As anticipated, all three sub-indices are individually related to subsequent growth rates. Fig. 6 displays coefficient plots for specifications akin to Model 1.1. All indices range from 0 to 1, and coefficients are thus comparable. Interestingly, the WPE estimate is around twice the size of the sub-indices. Going from minimum to maximum on any of these sub-indices is predicted to increase growth rates by 1.0 to 1.2 percentage points, and all three coefficients are *at least* weakly significant (10% level).[9] Moreover, all three sub-indices, and especially civil liberties and political participation, are quite robust to specification changes such as altering the dependent variable specification (Ln GDP p.c. instead of GDP p.c. growth) or using Maddison GDP data. Overall, there is evidence indicating that different aspects of WPE carry an independent relationship with subsequent growth, *and* that the relationship is stronger for the composite concept than for any individual sub-component.

5.4. Women's political empowerment and technological change

Finally, we investigate another implication from our argument, namely that improvements in WPE enhance technological change. Hence, even when disregarding economic growth coming from investments in physical or human capital, WPE should be related to higher residual growth, which is presumably driven mainly by adoption of new or improvements in various existing production or organization technologies (Helpman, 2004).

We draw on the above-described, extensive TFP data from Baier et al. (2006) stemming from a comprehensive growth accounting exercise. When following the interpolation procedure used by Knutsen (2015), we can re-run our benchmark – substituting Ln GDP per capita from Model 1.3, Table 2 with Ln TFP – on 6841 country-year observations from 142 countries. The longest time series (United Kingdom) extends from 1831–2000. Model 3.1 in Table 4 reveals a positive and significant (5% level) relationship between WPE and Ln TFP measured five years later, conditional on initial level of Ln TFP and country- and year-fixed effects. A back-of-the-envelope calculation, assuming constant TFP growth rate over the five-year period, implies that going from minimum to maximum on WPE increases the annual TFP growth rate by about 1.8 percentage points. The implied increase in GDP per capita growth rate for the same change in WPE (from the corresponding Model 1.3 on Ln GDP per capita) is 2.2 percentage points,

[9] When including all sub-indices simultaneously in the benchmark, the civil society index turns close to 0, whereas the civil liberties (1.2; $t=1.7$) and political participation (0.9; $t=1.4$) indices basically retain their sizes but obtain lower t-values.

Table 4
Fixed effects OLS regressions on Ln Total Factor Productivity (TFP).

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)
				1-year panels				5-year panels	
DV measured in	$t+5$ b/(t)	$t+10$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)	$t+5$ b/(t)
Women pol. emp.	0.090**	0.142*	0.070	0.069	0.095**	0.085**	0.091**	0.116**	0.116*
	(2.083)	(1.859)	(1.241)	(1.506)	(2.164)	(2.041)	(2.044)	(2.284)	(1.810)
Ln TFP	0.931***	0.635***	0.933***	0.941***	0.957***	0.909***	0.938***	0.938***	0.941***
	(37.432)	(12.652)	(35.749)	(32.030)	(30.785)	(32.739)	(36.563)	(36.312)	(34.981)
Polyarchy			0.018						0.000
			(0.465)						(0.011)
Resource dependence				−0.002***					
				(−2.737)					
Agricult. Inc. share					0.001**				
					(2.332)				
Ln population						−0.056**			
						(−2.154)			
Civil war yrs, decade							−0.001		
							(−0.315)		
Country dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	6841	6137	6804	6241	5973	6699	6509	1456	1447
R^2	0.839	0.607	0.838	0.840	0.839	0.833	0.838	0.826	0.826

Notes: *p<0.1; **p<0.05; *** p<0.01. Errors are clustered by country.

suggesting that the increased TFP growth makes up about 4/5 of the total increase in GDP per capita growth (drawing on common assumptions of neoclassical growth models; see, e.g., Jones, 2001). [10]v. /nb

The WPE coefficient is somewhat sensitive to specification choices. For instance, the t-value drops from 2.1 to 1.9 once measuring the outcome ten years after the covariates in Model 3.2, but WPE increases markedly in size (from.09 to.14). This latter observation suggests that there are longer term benefits to technological efficiency from increased WPE, beyond the notable short-term benefits. Tests on even longer lags show that the relationship observed for the 10-year lag is fairly persistent, whereas shorter lags show a much smaller and insignificant relationship (see Appendix Fig. A.5).

We discussed for the growth regressions how several variables, notably democracy, may be relevant controls, even if adding them could introduce post-treatment bias for WPE. The same points apply here. Model 3.3 includes Polyarchy as an additional control, and this attenuates WPE by more than 20 percent (from 0.09 to 0.07) relative to the benchmark. Moreover, WPE now turns statistically insignificant ($t = 1.2$). WPE is not robust to controlling for natural resource dependence (Model 3.4) either, but, further tests show that this result comes from the reduced sample; WPE in Model 3.1 is insignificant and similarly sized for the reduced sample of 6241 observations. And, WPE remains stable in size and at least weakly significant when controlling for other factors that may plausibly influence both WPE and TFP growth, including agricultural share of production, population size and number of years in civil war over the last 10 years (Models 3.5–3.7). Likewise, WPE is quite stable and significant at least at 10% when controlling for other confounders that we tested for GDP p.c. growth, namely agricultural inequality, urbanization rate, years as independent state, recent inter-state war history, and recent regime instability (Appendix Table A.12). Still, WPE is more sensitive to the control strategy in the TFP regressions than in the GDP per capita regressions.

The lack of robustness could stem from different factors. It might, of course, be that the effect of WPE on growth mainly stems from WPE enhancing factor accumulation, for instance through increasing labor force participation or human capital for women. But, there are also methodological explanations for the weaker results. First, the GDP regressions included far more country-year observations, thus giving more efficient estimates and a lower likelihood of conducting Type II errors. Further, the results for Models 3.1–3.7 may be weakened by measurement error induced from the interpolation routine in the country-year panels. The TFP data are originally measured with intervals of several years (typically 10), and the interpolation procedure artificially smooths out growth across these longer intervals. Hence, Models 3.8 (benchmark) and 3.9 (adding Polyarchy) employ 5-year panel units. While results are fairly similar, WPE is somewhat larger in size and now weakly significant in the model including Polyarchy. In sum, there is some, but not robust, evidence that women's political empowerment is related to faster subsequent technological change.

One concern is that the reported correlation is driven by the reverse causal relationship, namely that the accumulated (level of) technology in society or recent patterns of technological change influence the political empowerment of women in systematic manners. We find it likely that such reverse causal relationships exist, and this aligns with existing research on how certain technologies facilitate the empowerment of women, particularly through enhancing female labor force participation, which may, in turn, indirectly enhance women's political empowerment (Iversen & Rosenbluth, 2008). For instance, several studies show that the spread of home appliance technologies such as dishwashers, freezers, and washing machines increase female labor force participation by reducing time allocation to home production (de Cavalcanti, Tiago, & Tavares, 2008; Coen-Pirani, León, & Lugauer, 2010). Others have shown how more efficient birth control technologies empower women – including those who do not use them – by reducing birth rate and increasing labor force participation (Chiappori & Oreffice, 2008).

Despite these considerations, and the fact that it is impossible to fully account for resulting endogeneity biases with

[10] We caution against interpreting this calculation too literally, as it draws on strong assumptions and both estimates are related to considerable uncertainty and vary with the specification. When both specifications are estimated on the same sample of 6,552 observations, for example, the implied effect on TFP growth makes up 87 rather than 82 percent of the implied effect on total GDP per capita growth.

observational data, we are not exceedingly worried that this is driving results for WPE in Table 4. First, we control for initial level of Ln TFP in all regressions, thus capturing differences in level of total factor productivity at (and thereby long-term patterns of accumulated technological change up to) the time WPE is measured. Second, tests on various leads and lags (Appendix Fig. A.5) show no positive relationship between WPE measured in $t = 0$ and the outcome variable measured in $t < 0$, but a positive relationship for $t > 0$ that is increasing as t increases. Controlling for the covariates in our benchmark, WPE is thus not clearly correlated with past realizations of TFP, but positively correlated with subsequent TFP. Yet, we tried out another strategy to mitigate any remaining endogeneity bias (following, e.g., Acemoglu et al., 2019), adding multiple lags on the dependent variable to the benchmark as controls. The idea is to account for past trends in TFP growth that influence both WPE and subsequently measured TFP. We tested models with up to ten lags, and tried out both annual and 5-year specifications. The results for WPE is actually more robust once controlling for multiple lags, holding up not only in the benchmark (Table A.13), but also in most specifications simultaneously controlling for level of democracy (Table A.14). Hence, these tests add to our confidence that the results for WPE are not simply a product of a causal effect running from technological development to women's political empowerment.

Finally, we asses potential heterogeneity across regime types, time, and geographic region, similarly to what we did for GDP per capita growth. The results are presented in the Appendix. Briefly summarized, we do find very clear and robust patterns of heterogeneity for WPE and TFP growth. There is some evidence that this relationship is stronger in democracies than in autocracies, although the differences are not consistently significant across specifications. The same goes for time period, with specifications including year-fixed effects indicating that the relationship has strengthened in recent years. Yet, specifications without year-fixed effects show less evidence of this pattern. One potential reason for the weak results and large uncertainty associated with the early years, could be lower data quality and more unsystematic measurement error. But, we also note that there are fewer observations included in the early sub-samples, which should increase standard errors and possibly also induce sample selection biases. For instance, only 72 countries appear in the 1860–1959 sample whereas 142 countries included in the 1909–2010 sample. WPE becomes closer in size and significance for these two time periods once we re-run them only on the joint set of 72 countries covered in both time series (Appendix Table A.11). Finally, the relationship appears to be quite consistent across geographical space, and sensitivity analyses omitting different regions of the world report almost similar results no matter what region is left out.

6. Conclusion

We have argued that political institutions that enhance key aspects of women's political empowerment – pertaining to the representation, voice, and active participation of women in politics and civil society – influence a country's rate of technological change. Such empowerment should enhance technological change both through affecting the variety of new ideas introduced into the economy as well as the selection of more efficient ideas. Since technological change, broadly defined, is the key "immediate determinant" of long-term economic growth, we also anticipate that WPE enhances economic development.

Drawing on data from 182 countries and extensive time series, we found evidence for different implications from our argument. The most robust evidence pertains to WPE being positively related to subsequent economic growth. This relationship holds up for different measurement strategies and statistical specifications. Reassuringly, the relationship holds up when accounting for country- and year-fixed effects, past trends in growth, and several other possible confounders. Second, measures capturing all three subcomponents of empowerment are individually linked to growth. Third, we also find some evidence indicating that empowerment relates to TFP growth, an indicator of technological change.

While the data at hand do not allow for strict causal interpretations, and sources of endogeneity bias may remain despite our best efforts at mitigating them, we believe that the most plausible interpretation of our results is that WPE enhances technological change and thus economic growth. If so, our results could have real-world relevance, insofar as some decision-makers are more concerned with economic performance than questions of justice and equity in representation, inclusion, and protection of rights for women. The inclusion of women in politics may not only be justified by intrinsic, normative motives; there is also a more instrumental "business case" to be made for the political empowerment of women. This case might help sway otherwise reluctant social groups and decision makers to work for, or at least acquiesce to, including women in political life. Despite some progress, worldwide, in recent decades (World Bank, 2020b), substantial restrictions remain on women's opportunities to participate on equal footing with men, both in politics and the economy. Around a third of the world's countries restrict freedom of movement for women, 40 percent have legal restrictions on women's labor market choices, and around 40 percent discriminate against women in their property rights legislation. In 115 countries, women cannot run a business in the same way as men (ibid). These striking inequalities, we surmise, are related to the lacking political representation and influence of women. In 2019, only 24.6 of parliamentary seats worldwide were held by women (World Bank, 2020a), and the corresponding number for cabinet seats was 20.7 (IPU and UN women Union (2019)). Even today, there is ample room for increased political representation and participation by women in most countries. Our results suggest that, for these countries, there is corresponding room for more rapid technological change and economic development.

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.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, athttps://doi.org/10.1016/j.worlddev.2022.105822.

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