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Education and Military Spending: Countervailing Forces in Designing an Economic Policy for Peace

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Education and Military Spending: Countervailing Forces in Designing an Economic Policy for Peace *

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Abstract

This paper contributes to peace research by assessing the viability of an economic policy instrument for sustaining social peace. The central argument posited herein is that the ratio of public investment in education to military expenditure (henceforth referred to as Edumilex) serves as a meaningful instrument for promoting policies conducive to peace. To empirically evaluate the impact of Edumilex on peace, we construct a measure of domestic peace (henceforth referred to as Social Peace Index) structured around four core dimensions: (i) Health, (ii) Standard of living, (iii) Quality of institutions, and (iv) Spread of violence. Utilizing a panel dataset of 88 countries from 1990 to 2020, we estimate the impact of Edumilex on Social Peace Index through an IV/2SLS estimator. The findings reveal a robust and positive relationship, suggesting that Edumilex holds potential as an effective tool for economic policy geared toward peace. In addition, we document a systematic climatic dimension: hydroclimatic stress—captured by the Standardized Precipitation Evapotranspiration Index (SPEI)—is negatively associated with social peace, whereas CO_2 emissions per capita (used as a proxy for development) correlate positively with the index, consistent with the climate–conflict literature emphasizing the role of climatic shocks and vulnerability (Harari and La Ferrara, 2018; Ide et al., 2021; von Uexkull et al., 2016). This proposition represents an innovative departure from traditional perspectives, as governments typically treat education and military spending as discrete policy areas. However, our results suggest this perspective may be limited, as both sectors critically impact peace. By linking these domains, this study clarifies the broader implications of balanced public spending, offering insights for policymakers on fostering stable, peaceful societies through integrated economic strategies.

JEL classification: H56, H52, O47.

Keywords: Peace, Education, Military Expenditures, Development.

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1 Introduction

This paper takes Jan Tinbergen seriously. In his well-known 1956 book Tinbergen listed 'International Peace' as the first objective of economic policy. In his words: *"Maintainance of international peace. This point would not have usually been considered as an item on the agenda of economic policy even up to a few decades ago. Today it has to be, since the very foundations of our existence are at stake"* (Tinbergen, 1956). Tinbergen was the first who listed 'International Peace' as a primary objective of economic policy as he recognized that peace is essential for substantive, long-term economic development.

In his review of the book, Arrow (1958) highlighted a significant gap, noting, *"Actually, the aim of peace, despite its prominence on the list, is referred to again only once in the book and then in a manner which can be described best as an obiter dictum. Clearly, peace affects economic well-being as it affects most other things but it seems to me that it can hardly be regarded as an aim of policy until it can be shown that economic policy affects peace"*. (Arrow, 1958). Arrow underscores a discrepancy between the ambition of incorporating peace as a primary goal of economic policy and the mechanisms available for effectively achieving it. This challenge reflects a broader issue: translating high-level objectives, such as peace, into actionable economic policy remains complex, particularly without clear pathways by which economic actions directly influence peace outcomes. Arrow suggested that peace can become a viable policy aim only if supported by evidence linking economic strategies with tangible peace effects, bridging the vision of Tinbergen with practical policy tools.

This study addresses the challenge posed by Arrow by attempting to integrate peace as an objective of economic policy through the proposal of a policy instrument for achieving peace. The theoretical framework employed adheres to the Tinbergen Rule, which posits that for each policy target, there must be at least one directly controllable policy instrument. This research adopts the most parsimonious framework: one policy instrument for one policy target.

However, differently from Tinbergen, we focus on domestic peace rather than international peace. Specifically, the policy target identified in this research is the level of peacefulness that a country can achieve internally. The term *peace* in this context refers to positive peace. Indeed, our perspective is that negative peace, namely the absence of physical violence, may be insufficient to define a country as peaceful. In more precise terms, it is an overly narrow definition that does not capture the actual level of peace. Due to the lack of consensus among scholars on a definition of positive peace, and consequently a measure thereof, we develop a concise metric of positive peace (hereafter referred to as Social Peace Index), encompassing four pillars: (i) *Health*; (ii) *Standard of living*; (iii) *Quality of institutions*; (iv) *Spread of violence*.

To achieve the policy target of domestic positive peace, we propose as a policy instrument the ratio of public education investment to military expenditure (hereafter referred to as Edumilex). Edumilex is conceptually derived from Baumol (1990), who posits the ratio between potentially productive and unproductive activities within societies as a critical factor for long-term development. More concisely, we posit that the establishment of domestic peace over time can be attributed to the ratio between educational and military allocations.

To empirically validate the effectiveness of Edumilex as a valid policy instrument for internal peace, we conduct an empirical analysis. Specifically, we estimate the impact of Edumilex on the Social Peace Index, utilizing a panel comprising 88 countries spanning the years from 1990 to 2020. To account for potential reverse causality, we employ an instrumental variable approach.

Empirical findings demonstrate that Edumilex is robustly and positively associated with the Social Peace Index.

The structure of this paper is as follows: Section 2 introduces the policy target, the Social Peace Index. Section 3 discusses the policy instrument, Edumilex. Section 4 details the empirical methodology employed in the analysis. Section 5 presents the results of the empirical analysis. Finally, Section 6 provides conclusions and suggests directions for future research.

2 The policy target: *Social Peace Index*

The concept of peace lacks a universally accepted definition, although it is extensively studied within the frameworks of stability, security, and development. Broadly, two primary definitions of peace can be distinguished: (i) negative peace and (ii) positive peace. Negative peace denotes the absence of direct violence or conflict, emphasizing the reduction of immediate threats, frequently quantified through war or crime rates. Studies on conflict have traditionally employed a definition of peace that is characterized by the absence of violent conflict. Positive peace, conversely, represents a more comprehensive concept that encompasses conditions conducive to social cohesion, economic opportunity, and institutional effectiveness.

To illustrate the limitations of using negative peace as a measure of peacefulness, we provide anecdotal evidence based on data from the Armed Conflict Location Event Data (ACLED) project. ACLED compiles detailed information on the type, actors, location, date, and other characteristics of events of political violence. Among these, riots are categorized as violent events involving demonstrators or mobs of three or more individuals engaging in destructive actions, such as physical altercations, rock-throwing, property damage, and similar activities. Table 1 summarizes the total number of riots recorded in selected countries during the 2020–2024 period and their corresponding rates per 100,000 inhabitants. Notably, India emerges as the country with the highest absolute number of riots (10,601), making it appear as one of the "least peaceful" countries in this dataset. Conversely, Russia and China report the lowest absolute numbers of riots — 66 and 166, respectively — over the same period. Adjusting for population, these two countries also exhibit the lowest riot rates per 100,000 inhabitants, at 0.05 and 0.01, respectively, suggesting that they are the most "peaceful" in this dataset. In stark contrast, France displays the highest riot rate per 100,000 inhabitants (2.71), positioning it as the "least peaceful" country in relative terms.

Country	Riots	Riots per 100,000 inhabitants
India	10,601	0.75
France	1,843	2.71
Democratic Republic of Congo	1,651	1.64
Pakistan	1,631	0.68
United States	1,490	0.45
Iraq	987	2.26
Iran	853	0.96
Germany	754	0.90
Italy	699	1.18
Syria	494	2.23
China	166	0.01
Russia	66	0.05

Table 1: Riots in selected countries (2020-2024)

Although the data may indicate that countries like Russia and China are among the most

peaceful due to their low riot rates, this interpretation is misleading when assessed through the broader definition of peace. Negative peace, which is characterized by the absence of overt violence or conflict, fails to account for deeper factors that contribute to sustainable and authentic peace. Low riot frequencies in authoritarian regimes such as Russia and China often reflect stringent control, suppression of dissent, and restrictions on freedoms, resulting in artificially low levels of visible unrest rather than genuine societal harmony (Carter and Carter, 2021; Guriev and Treisman, 2020; Keremoğlu and Weidmann, 2020). Moreover, negative peace overlooks structural violence, including systemic inequality, discrimination, or the denial of basic rights, which may persist even in the absence of physical violence, fostering latent societal tensions. In contrast, higher riot frequencies in democratic nations like France may reflect robust civic engagement and the freedom to express dissatisfaction openly, illustrating a society actively addressing its challenges rather than suppressing them (Hollyer et al., 2011; Stier, 2015). This example highlight the limitations of equating absence of physical violence with peace.

While it is evident that positive peace differs from negative peace, the literature lacks a precise definition of positive peace.

Boulding (1963, 1978) posits that peace is intrinsically linked to the concept of stability. He argues that peace is not merely the absence of conflict but rather a 'homeostatic' quality—a self-regulating mechanism that maintains stability by detecting and countering early signs of tension. According to Boulding, a stable peace system incorporates proactive mechanisms for perceiving and addressing moves toward conflict in their early stages (Boulding, 1963). However, as he noted, policies focused primarily on defense lack this preventative approach to peace. Instead of a genuine 'policy for peace', governments largely adopt defensive measures, which Boulding considers insufficient. His perspective emphasizes the necessity for a structured policy framework that transcends mere defense in order to create conditions for actively sustaining and promoting peace. In this framework, peace becomes a proactive characteristic of systems, where societal and governmental institutions can anticipate and mitigate conflict through early intervention. In the perspective of Boulding a peace-supporting infrastructure should both addresses both immediate threats and fosters long-term stability.

Klein et al. (2008) offer a definition of international positive peace based on four dimensions: (i) the absence of major territorial claims, (ii) institutions for conflict management, (iii) high levels of functional interdependence, and (iv) satisfaction with the status quo. By identifying key dimensions that contribute to positive peace, such as conflict management institutions and interdependence, Klein et al. (2008) formulate a normative framework for the creation and support of a stable environment. In line with Boulding's approach, their perspectives underscore that peace requires active, structured mechanisms that foster cooperation and address underlying tensions, rather than simply mitigating conflict.

Galtung (1969) proposed a definition of peace closely related to development. According to Galtung, peace is a two-dimensional concept: it encompasses both (i) the absence of direct, overt violence (negative peace) and (ii) the absence of structural violence (positive peace), where society is characterized by social justice and an egalitarian distribution of power. He asserts that peace cannot merely imply controlling or reducing violent behaviors; it must also address societal structures that perpetuate inequality and restrict individuals' opportunities. Consequently, peace theory is inherently intertwined with both conflict theory and development theory: conflict resolution aligns more with achieving negative peace by stopping violence, while development theory fosters positive peace through the establishment of just and equitable systems. In his words,

"This means that peace theory is intimately connected not only with conflict theory but equally with development theory. And peace research, defined as research into the past, present, and future conditions for realizing peace, will be equally intimately connected with conflict research and development research; the former often more relevant for negative peace and the latter more relevant for positive peace, but with significant overlaps" (Galtung, 1969). This perspective implies that achieving lasting peace involves constructing a society where individuals have equal opportunities and resources, thereby focusing peace research on both eliminating violence and promoting justice.

While these definitions differ, they share several common characteristics: (i) peace is a structural feature of a society, and (ii) it does not merely concern the absence of violence, but necessitates (iii) institutional settings that contribute to both (iv) reducing incentives for conflict and (v) anticipating violence by fostering an environment for peacefully resolving disputes.

Building on these premises, we propose the construction of an index of domestic peace that incorporates both economic and political determinants of peace. This index aims to integrate these two dimensions, which, while often interconnected in their influence on one another (Acemoglu and Robinson, 2012), are not tipically evaluated in conjunction within a unified framework. The Social Peace Index, which aims to synthesize all the aforementioned considerations, is constructed as the geometric mean of four pillars: (i) *Health*, (ii) *Standard of Living*, (iii) *Quality of Institutions*, and (iv) *Spread of Violence*. In our assessment, each dimension captures a distinct aspect of the various definitions of peace. More specifically, the first two pillars serve as closer proxies for economic development, while the latter two more accurately reflect political development.

The primary advantage of the Social Peace Index lies in its parsimony. While peace is undoubtedly a holistic concept encompassing multiple dimensions, constructing an overly comprehensive index may prove impractical for empirical analysis due to challenges such as endogeneity. By carefully selecting specific variables, the goal is to develop a simple yet parsimonious index that effectively captures internal peace. Below, we present a theoretical justification for the dimensions identified for constructing the index. In the subsequent paragraph, we detail how each of these dimensions has been operationalized.

The first pillar of our index is *Health*. An increase in the *Health* status of a country enhances human capital and enables individuals to contribute productively over longer periods. It supports sustained economic growth by increasing the duration of workforce participation and stimulates greater savings and investments. Moreover, the *Health* status of a population serves as both an indicator of developmental progress and an indirect measure of societal inequality when considered in conjunction with *Standard of Living*. These indicators capture efficacy and equity of resource distribution within a society. Population health outcomes are influenced by access to essential resources, including healthcare, nutrition, and living conditions, which subsequently reflect the degree of equitable allocation of economic resources. Consequently, disparities in health outcomes frequently reveal underlying socioeconomic inequalities, rendering health, in combination with standard of living, a valuable metric for assessing broader social equity (Sen and Anand, 1994).

The *Standard of Living* dimension also serves as a critical indicator of a country's level of economic development and the general quality of life. Both Galtung (1969) and Collier and Hoeffler (2004) posit that economic development influences the opportunity cost of engaging in conflict, albeit from different perspectives. Higher standards of living tend to increase the opportunity costs to engage in a conflict, as individuals and groups have more to lose from the destruction associated with conflict. Conversely, low standards of living, often accompanied by inequality, exacerbate competition over scarce resources, which has been widely recognized as a trigger for civil conflicts

and an impediment to lasting peace. Higher standards of living are essential for peace as they address basic human needs, and may reduce the socio-economic grievances that often lead to conflict. By fostering economic security, improved living conditions enhance stability. Furthermore, prosperous societies are better equipped to invest in mechanisms for conflict prevention and resolution, supporting both the absence of violence (negative peace) and the establishment of equitable societies (positive peace).

The third dimension of Social Peace Index is the *Quality of Institutions*. Historical evidence demonstrates that economic success can apparently coexist with authoritarian rule, though it often involves significant social and political trade-offs, as exemplified by China. Over the past few decades, China has experienced remarkable economic growth, transitioning from a predominantly agrarian economy to the world's second-largest economy by 2024, driven by industrialization, urbanization, and state-controlled market reforms. Nonetheless, according to the Electoral Democracy Index by V-Dem, its score declined by 18% in 2020 compared to 1990, marking a significant decrease in the quality of political institutions. The fact that economic development does not necessarily imply the presence of robust political institutions leads us to incorporate a dimension of institutional quality in our index. The *Quality of Institutions* dimension seeks to encompass the broader political, economic, and social context within which individuals reside and interact. As North (1991) aptly defines them, *"institutions are the humanly devised constraints that structure political, economic, and social interaction"*. High-quality institutions promote stability, transparency, and accountability, thereby establishing an environment in which individuals can engage in economic and social activities with a sense of security and equity. Acemoglu and Robinson (2012) categorize institutions into two broad types: (i) extractive institutions that exclude significant portions of the population from benefiting from their contributions, impede widespread participation in economic relations, and concentrate political power within a narrow elite. Such institutions are predicated on exploitation and marginalization, which not only intensify incentives for violence but also rely on violence for their perpetuation. In contrast, (ii) inclusive institutions advocate for the right of all citizens to participate in economic and political activities. These institutions are closely associated with development, a critical factor for peace according to Galtung (1969).

Ultimately, the *Spread of Violence* dimension measures the extent of physical violence within a country. As previously noted, althoug the absence of conflict is insufficient for defining peace it remains a necessary condition . The level of physical violence is closely linked to both the economic and political development of a country. North et al. (2009) present a theoretical framework to explain why societies vary in their levels of violence. The authors distinguish between two types of social orders: the natural state and the open access order. The natural state refers to a social order where elites maintain control over both political and economic power, with institutions structured to protect their interests. In such systems, access to political and economic opportunities is restricted, and wealth and resources are allocated in ways that benefit the ruling elite. In contrast, an open access order is characterized by widespread participation in both political and economic spheres. In this system, institutions are designed to be inclusive, providing individuals with opportunities to engage in economic and political activities without requiring elite approval. The authors emphasize that in the natural state, political stability is maintained through a balance between elite interests, often accompanied by the use of violence for control and coercion. In an open access order, however, elites have less incentive to use violence to maintain power, as the system is structured to facilitate peaceful competition and governance. Although not sufficient to fully

capture peace, our index also incorporates a measure of physical violence, which, in conjunction with other domains, serves as one of the pillars for defining peace.

2.1 The Social Peace Index: Methodology

From a methodological perspective, the development of the Social Peace Index is inspired by the conceptual framework of the Human Development Index (HDI) developed by the UNDP. Specifically, following the HDI framework, our social peace proxy is defined as the geometric mean of four key pillars: (i) *Health*; (ii) *Standard of Living*; (iii) *Quality of Institutions*; and (iv) *Spread of Violence*. Therefore, our measure of social peace is represented as follows:

$$Social\,Peace_{it} = (Health_{it} \times Standard\,of\,Living_{it} \times Quality\,of\,Institutions_{it} \times Spread\,of\,Violence_{it})^{\frac{1}{4}}$$

Each dimension is measured by one indicator which is normalized in a 0-1 range.

Following the HDI, the first dimension *Health* is proxied by means of a female life expectancy index. Then, it is computed as:

$$Health_{it} = \frac{Female\,Life\,Expectancy_{it} - 20}{85 - 20}$$

The benchmarks for standardizing the indicator between 0 and 1 are derived from the HDI.

Life expectancy serves as a crucial indicator, reflecting the average number of years an individual can expect to live. This measure is influenced by various factors, including the quality of healthcare, nutritional standards, and overall living conditions. The choice to utilize female life expectancy rather than overall life expectancy stems from concerns regarding gender discrimination. While biological factors typically enable women to outlive men by approximately five years, numerous social determinants adversely affect the health status of women to a greater extent than men. Improvements in this indicator may denote enhanced living conditions and the significant contributions of women to these advancements. Furthermore, examining female life expectancy in cross-country comparisons elucidates disparities not only in overall health conditions but also in access of women to essential social determinants of health, such as education and employment opportunities (Friberg et al., 2020).

The second dimension *Standard of living* is proxied through the level of GDP per capita. It is computed as:

$$Standard\,of\,Living_{it} = \frac{ln(GDP\,per\,capita)_{it} - ln(100)}{ln(75,000) - ln(100)}$$

The benchmarks for standardizing the indicator between 0 and 1 are based on the Human Development Index. The lower bound is set at \$100, reflecting the substantial volume of unmeasured subsistence and nonmarket production in economies at the minimum level, aspects not captured in official data. The upper limit is established at \$75,000 per capita, beyond which Kahneman and Deaton (2010) found minimal additional gains in human development and well-being from income. Since each dimension index serves as a proxy for capabilities, the transformation from income to capabilities is likely concave, as noted by Anand and Sen (2000), indicating that each additional dollar of income has a diminishing effect on expanding capabilities. Consequently, we employ the natural logarithm of actual, minimum, and maximum income values. While GDP per

capita has limitations—most notably its failure to account for income distribution—it remains a viable measure of long-term economic development.

The third dimension *Quality of Institutions* is proxied by the Rule of Law Index from the V-Dem project. The index ranges from 0 (low) to 1 (high). The Rule of Law Index measures the extent to which laws are enforced transparently, independently, predictably, impartially, and equally, as well as the degree to which government officials comply with the law. The choice to prioritize the Rule of Law Index over a general democracy index is driven by the fact that, while democratic features such as political participation and electoral competitiveness are important for assessing the broader political system, they do not directly measure the effectiveness of legal institutions or the quality of governance. In contrast, the Rule of Law Index specifically evaluates the functioning and integrity of legal systems. A robust rule of law is essential for ensuring fairness, accountability and stability within society. It offers a more nuanced understanding of how legal frameworks operate in practice, which is critical for fostering public trust in institutions and for the peaceful resolution of conflicts. By requiring that laws apply equally to all, regardless of social standing, it promotes impartial governance and accountability, holding political actors to account even between elections.

Eventually, the fourth dimension *Spread of Violence* is measured using the Physical Violence index from the V-Dem project, which assesses the safety of citizens from government-led political killings and torture. This index ranges from 0 to 1, with higher values reflecting lower levels of state-perpetrated violence. Essentially, it serves as an indicator of negative peace by gauging the extent of institutionalized violence inflicted by governments on their citizens. Building on the theoretical framework of North et al. (2009), we have chosen to employ a measure of state violence to operationalize the "spread of violence" dimension, rather than relying on a measure of private violence. State violence refers to acts of violence perpetrated by government institutions or agents acting on behalf of the state, while private violence involves acts of violence committed by individuals or non-state actors. Unlike private violence, which is often the result of personal or group conflict, state violence can become institutionalized and embedded within the functioning of state structures. Governments may employ violence as a tool to maintain political power, control dissent, or suppress opposition. When institutionalized, state violence transcends isolated incidents, potentially leading to systemic cycles of repression and conflict. This dynamic is particularly challenging to address, as the state typically holds control over both legal and coercive mechanisms, which can shield perpetrators from accountability and further entrench the use of violence as a means of governance.

2.1.1 A comparison with alternative indices

In this section, we present a comparative analysis of the Social Peace Index, the Human Development Index, and the Electoral Democracy Index (EDI) developed by V-Dem. The Human Development Index is defined as a composite measure that captures the average achievement in three fundamental dimensions of human development: (i) a long and healthy life, (ii) access to knowledge, and (ii) a decent standard of living. The Electoral Democracy Index, as formulated by V-Dem, evaluates the quality of electoral democracy within a given country. It provides a comprehensive assessment of the extent to which a nation adheres to the principles of electoral democracy, emphasizing the selection of political leaders through free and fair elections, as well as the capacity of citizens to influence political decisions via electoral processes. Both indices range

from 0 to 1.

Table 2 presents correlation coefficients between the Social Peace Index, the Human Development Index, and the V-Dem score. A strong positive correlation is observed between SPI and HDI, with a correlation coefficient of 0.805, suggesting that higher levels of social peace are generally associated with better human development outcomes. This aligns with the premise that SPI, which captures aspects of health, standard of living, institutional quality, and violence, is a meaningful indicator of broader societal well-being.

	Social Peace Index	Human Development Index	V- Dem
Social Peace Index	1.000		
Human Development Index	0.805*	1.000	
V-Dem	0.866*	0.579*	1.000

Table 2: Correlation

There is also a strong positive correlation between SPI and V-Dem, indicated by a coefficient of 0.866. This relationship suggests that countries with higher SPI values tend to have more democratic political structures, reinforcing the idea that democracy and social peace tend to mutually support each other. Additionally, the correlation between HDI and V-Dem is lower at 0.579, which suggests that while democracy and development are related, economic development does not necessarily imply an improvement in the political institutions of a country. The Social Peace Index stands out from other indicators due to its ability to integrate both economic and political development within a country. This comprehensive approach recognizes that focusing solely on economic or political development can hinder the accurate identification and measurement of peace. Graph 1 highlights this point by showing how relying on just one dimension can lead to misleading results. It illustrates the trends of the three indices for Belarus and Iran from 1990 to 2018.

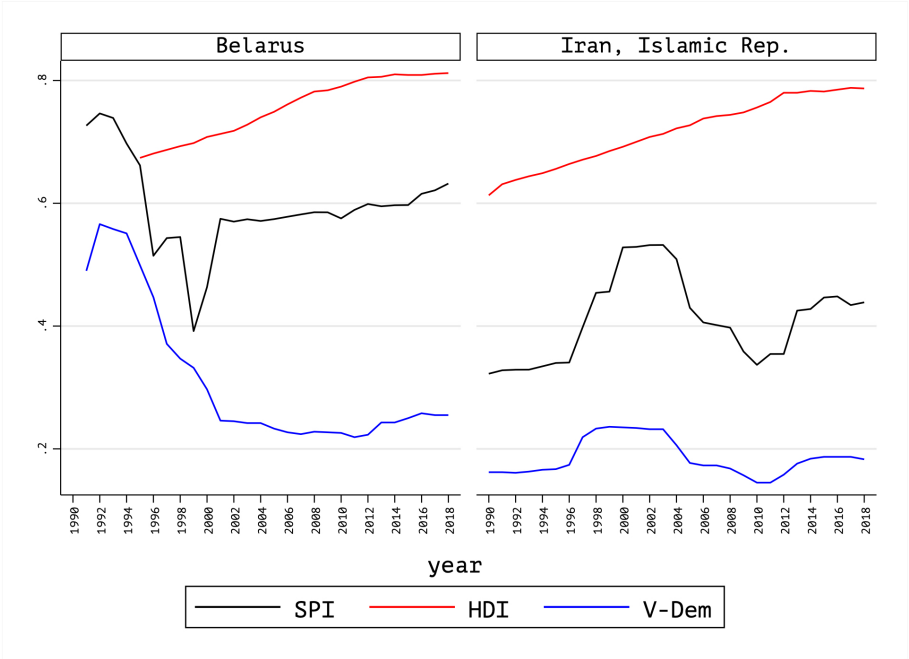

Figure 1: SPI - HDI - V-dem 1990-2018

In both Belarus and Iran, the trend in the Human Development Index steadily increased over time, indicating improvements in economic well-being during the period 1990–2018. More specifi-

cally, in Belarus, the HDI grew by 20% in 2018 compared to 1995 (the first year for which HDI data is available for Belarus). Similarly, in Iran, the HDI increased by 28% in 2018 compared to 1990. In contrast, the trends in political development, measured by the V-Dem Electoral Democracy Index, varied significantly between the two countries during the same period. In Belarus, since the beginning of Lukashenko's presidency in 1994, the level of democracy has followed a markedly negative trajectory, with the V-Dem Index decreasing by 48% in 2018 compared to 1995. At the same time, the HDI increased by 20%, highlighting a stark divergence between economic progress and political decline. However, the Social Peace Index decreased by 4% over the same period, offering a more balanced view that accounts for both improving economic well-being and deteriorating political institutions. This demonstrates the limitations of relying solely on the HDI or the V-Dem Index to measure peace. If peacefulness were assessed only based on economic development, Belarus might appear to have become more peaceful over time. Conversely, evaluating peace solely through political development would depict Belarus as a country where peace sharply declined. The Social Peace Index effectively captures both dimensions, making it a more comprehensive measure of peace. The case of Iran highlights additional challenges in using a single perspective to measure peace. Economic well-being, as measured by the HDI, shows a consistent upward trend, portraying a country that steadily improved over time. In contrast, political development, as reflected in the Electoral Democracy Index, reveals a more complex, curvilinear pattern, with periods of improvement (1995–2003 and 2011–2018) and periods of decline (2003–2011). Relying solely on the HDI would present Iran as a country of continuous progress, while focusing only on political development would reveal fluctuations in peace levels during the same period. Once again, the Social Peace Index proves to be a more suitable measure, as it reflects the fluctuations in political development while providing an intermediate score that balances both economic and political dimensions. This gives a clearer and more nuanced picture of peace in Iran.

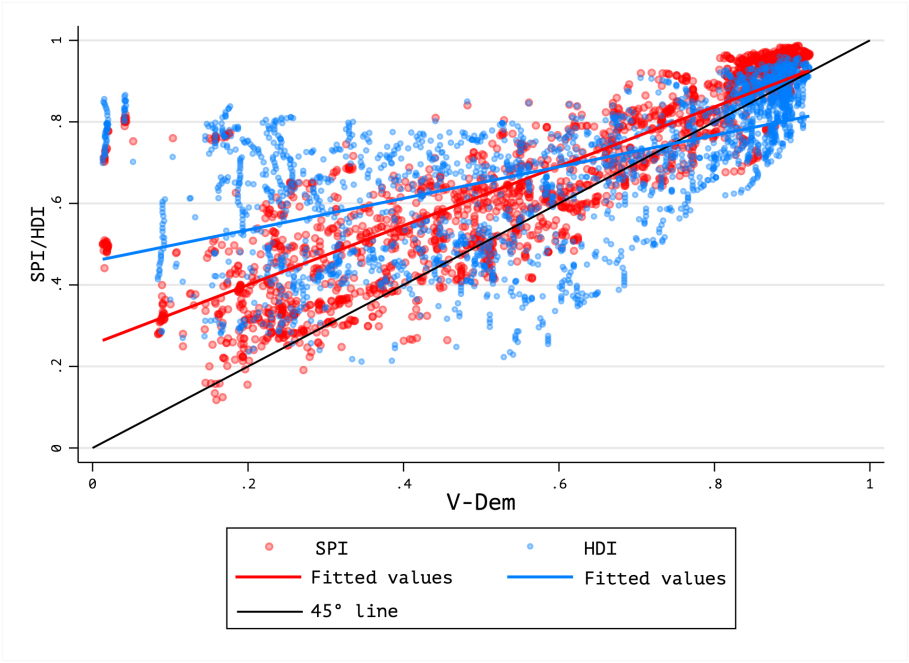

Figure 2: SPI - HDI - V-dem

Figure 2 illustrates the points discussed above by plotting the HDI score (blue points) and SPI

scores (red points) against V-Dem scores for all observations in our dataset. The figure shows that for higher V-Dem Index values, both the Human Development Index and the SPI align closely with the 45° line. This suggests that for countries with higher levels of political institutional quality, the three indices are somewhat interchangeable. In summary, we find that countries with strong political institutions also tend to have the highest levels of economic well-being and, of course, peace, since the SPI accounts for both economic and political development. However, for countries with medium to low V-Dem scores, we observe that not only are Human Development Index scores more dispersed, but they also show greater variation compared to the SPI. This indicates that countries with weaker democratic institutions exhibit more significant fluctuations in their levels of economic development. For these countries with lower levels of political development, the Social Peace Index provides a more nuanced perspective than the Human Development Index, as it simultaneously captures both economic and political dimensions. By integrating these two factors, the Social Peace Index offers a more balanced and accurate assessment of a country's overall peace status. In summary, the data reveals a convergence between economic and political dimensions for countries with high levels of both. However, the fact that economic well-being is not always associated with strong political institutions poses a significant challenge. This underscores the need for a comprehensive measure of peace, as relatively high levels of economic well-being, when paired with low to medium levels of political development, do not necessarily indicate true peace. The Social Peace Index provides a potential solution by capturing the interplay of these dimensions, offering a clearer understanding of peace.

2.2 The Social Peace Index: Facts and figures

Figure 3 shows the global average Social Peace Index from 1990 to 2020, rescaled to a 0-100 range. The index generally trends upward during this period, though there is a slight drop in the aftermath of the global financial crisis and a more pronounced decline after 2017. Closer examination of the four subcomponents (see Figure 4) reveals that this increase is largely due to improvements in two out of the four domains of the index: *Health* and *Standard of living*. Conversely, the Physical Violence Index which proxies the *Spread of violence* domain has worsened in more recent years, decreasing by 1.7% between 2018 and 2020. On average, while health outcomes and economic status have improved, levels of violence have not demonstrated a commensurate trajectory, revealing a more complex relationship between economic development and societal peace. This contrast explains why economic indicators alone may not adequately capture the peacefulness of a country. By focusing exclusively on economic development, one risks overlooking other critical aspects, such as safety and social stability, that are essential for a truly peaceful society. Thus, broader metrics that encompass social well-being and violence levels are necessary for a comprehensive assessment of peace.

In Figure 5 and 6, we present the regional trends of Social Peace Index and their subcomponent split by region.

Figures 5 and 6 reveal regional variations in the Social Peace Index and its components across different regions. As of 2020, North America, Europe and Central Asia stand out as the regions with the highest Social Peace Index scores, followed by East Asia and the Pacific. In Europe and Central Asia, the Social Peace Index has increased moderately by 4.3% since 1990, reaching 0.82 in 2020. Meanwhile, East Asia and the Pacific demonstrated a more substantial growth rate (14.27%) in Social Peace Index, though it peaked in 2012 at 0.71 and has seen some decline since.

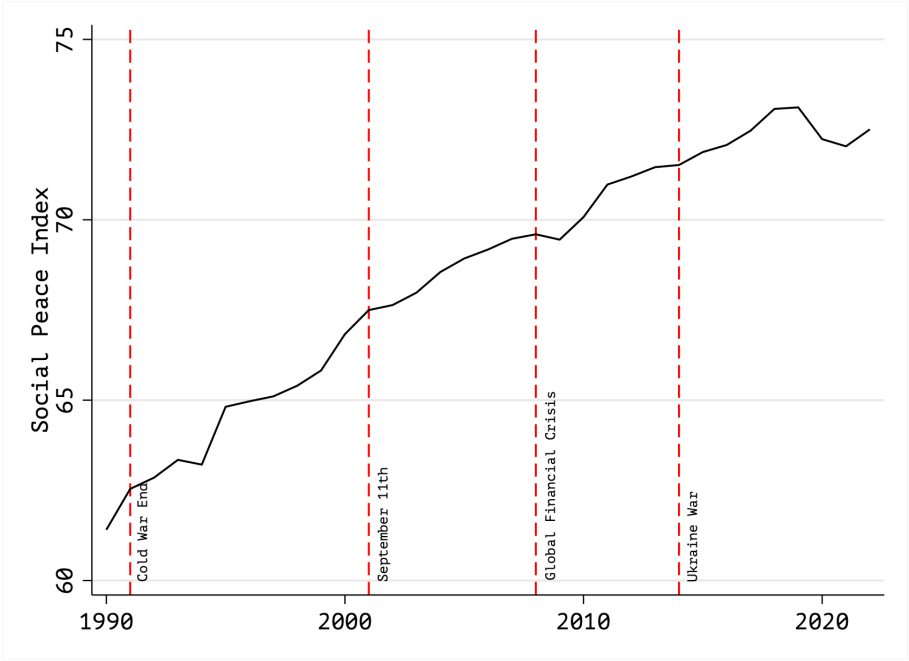

Figure 3: Social Peace Index 1990-2022

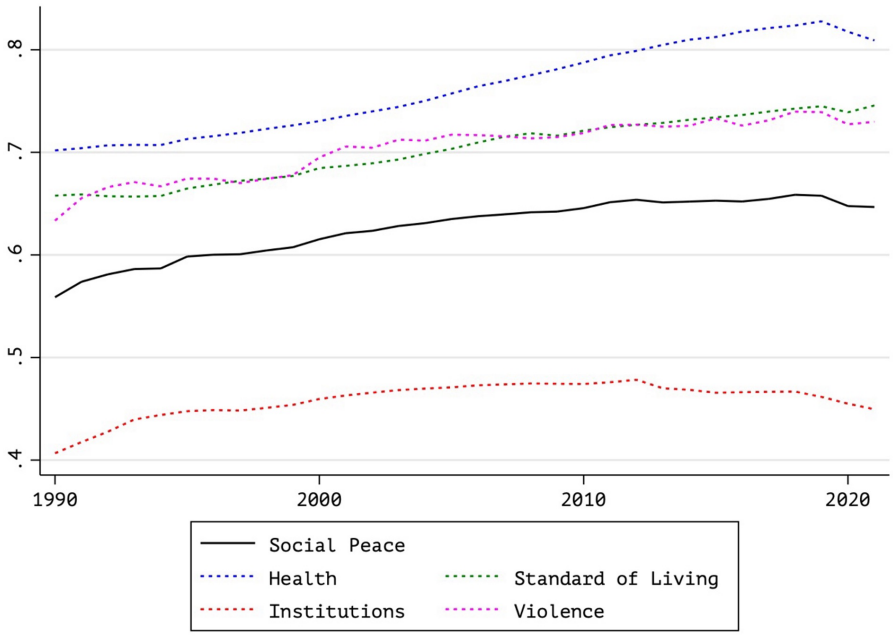

Figure 4: Social Peace Index - Components

Sub-Saharan Africa exhibited one of the strongest growth rates in SPI (42.3%) over the period, starting from a low base and peaking in 2019. Latin America and the Caribbean showed a long-term growth trend of 16%, with the Social Peace Index peaking in 2017 before a slight decline. In the MENA region, the SPI improved by 30.69% between 1990 and 2020, yet still falls notably behind European and East Asian levels.

Each region shows distinct characteristics in the four Social Peace Index domains. Across all

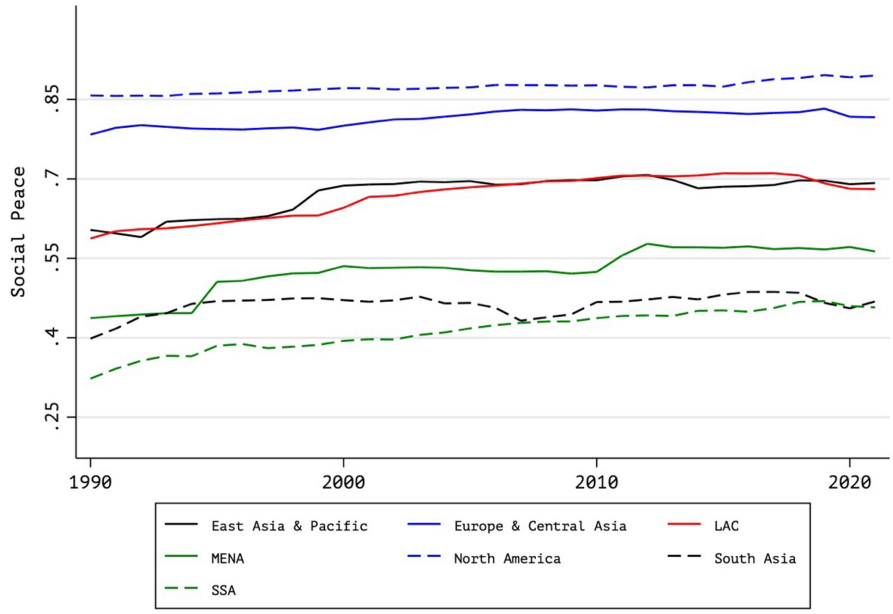

Figure 5: Social Peace Index - Regional trends

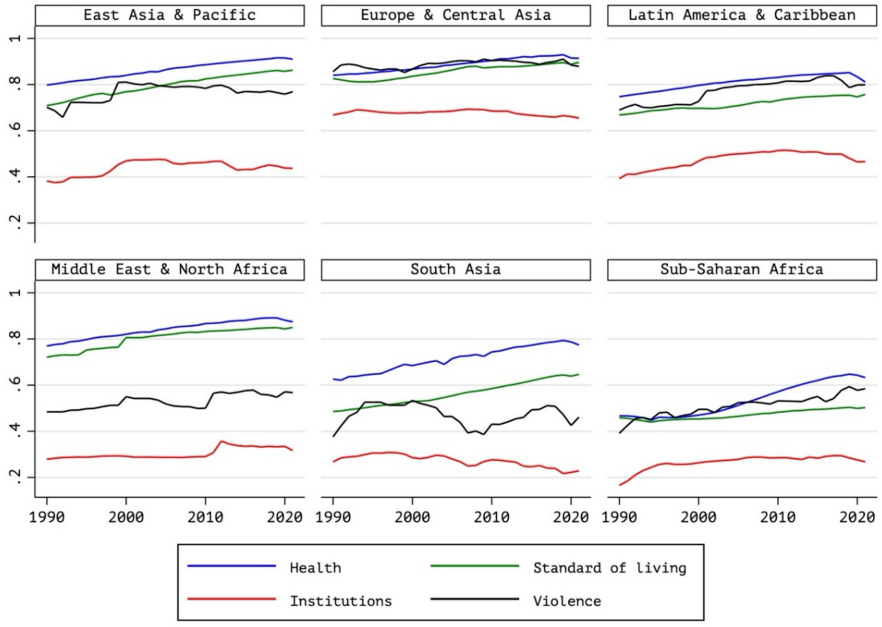

Figure 6: Regional trends of subcomponents of the Social Peace Index

regions, *Quality of Institutions* consistently lags as the lowest-performing domain, signaling ongoing governance issues. Conversely, *Health* and *Standard of Living* are the strongest domains, showing improvements that converge over time. However, SSA is an exception: in this region, *Health* outcomes have improved faster than *Standard of Living*, which may potentially indicate uneven socioeconomic progress. The *Spread of Violence* domain, capturing levels of government-perpetrated violence, presents significant variation across regions. Asia, particularly East Asia and the Pacific, demonstrates a notable long-term deterioration in violence levels, with a gradual

decline beginning in 2000. South Asia, however, experienced a sharp rise in violence between 2000 and 2010, followed by improvements before experiencing renewed deterioration in recent years. This variation in violence trends highlights distinct regional challenges in managing conflict and state violence, with some regions showing signs of worsening security conditions. In summary, while the Social Peace Index trends indicate general improvements in health and living standards across regions, the disparities in *Quality of Insitutions* and *Spread of Violence* suggest that economic growth alone does not secure reductions in institutionalized violence or improvements in governance quality. These findings emphasize the importance of a multifaceted approach to peace and development, where economic growth is complemented by governance reforms and reductions in violence to achieve lasting social peace.

Table 3 illustrates the Social Peace Index for selected countries across four historical periods, highlighting significant trends in regional stability.

		Aftermath of Cold War	**Post September 11th**	**Post 2008 Great financial Crisis**	**Post - 2014**
Country	**Region**	**1992-2001**	**2002-2008**	**2009-2014**	**2015-2020**
China	East Asia & Pacific	0.37	0.40	0.41	0.41
Indonesia	East Asia & Pacific	0.38	0.63	0.65	0.64
South Korea	East Asia & Pacific	0.80	0.86	0.85	0.88
Germany	Europe & Central Asia	0.90	0.91	0.92	0.92
France	Europe & Central Asia	0.88	0.90	0.91	0.91
United Kingdom	Europe & Central Asia	0.84	0.88	0.88	0.88
Italy	Europe & Central Asia	0.87	0.89	0.89	0.89
Türkiye	Europe & Central Asia	0.52	0.68	0.63	0.50
Argentina	Latin America & Caribbean	0.79	0.80	0.80	0.78
Brazil	Latin America & Caribbean	0.67	0.72	0.74	0.64
Colombia	Latin America & Caribbean	0.51	0.54	0.62	0.61
Iran	Middle East & North Africa	0.36	0.42	0.37	0.43
Israel	Middle East & North Africa	0.80	0.82	0.82	0.82
Saudi Arabia	Middle East & North Africa	0.39	0.38	0.39	0.38
India	South Asia	0.58	0.59	0.60	0.54
Botswana	Sub-Saharan Africa	0.63	0.64	0.68	0.69
Cameroon	Sub-Saharan Africa	0.39	0.41	0.42	0.42
Kenya	Sub-Saharan Africa	0.31	0.44	0.47	0.49
Rwanda	Sub-Saharan Africa	0.24	0.32	0.36	0.32
Tanzania	Sub-Saharan Africa	0.48	0.5	0.54	0.55
South Africa	Sub-Saharan Africa	0.55	0.64	0.67	0.67

Table 3: Social Peace Index Scores

In East Asia and the Pacific, Indonesia shows substantial progress, especially after 2001, while China demonstrates gradual improvement. South Korea maintains a high level of peace with steady gains. In Europe, while Germany, France, and Italy consistently report high Social Peace Index scores, Türkiye experiences notable fluctuations, peaking in the early 2000s before declining in recent years. In Latin America, Brazil sees a sharp increase post-2001, followed by a steep decline, while Colombia shows improvement, indicating a reduction in historical conflict-related instability. In Sub-Saharan Africa, Botswana and South Africa exhibit substantial gains, alongside incremental improvements in Kenya and Tanzania. However, Rwanda experiences a slight decline post-2014, suggesting potential setbacks. The overall analysis highlights increasing levels of Social Peace Index in parts of Asia and Africa, despite challenges in some regions, especially during global economic downturns and sociopolitical upheavals.

3 The policy instrument: *Edumilex*

The policy instrument for peace we propose is the ratio between public investment in education and military expenditures, (hereafter Edumilex for sake of brevity):

$$EDUMILEX = \frac{Publicinvestmentineducation}{Militaryspending}$$

Edumilex, firstly proposed by Caruso (2017), is fundamentally rooted in the work of Baumol (1990), who argued that the ratio between potentially productive and unproductive activities within societies is a critical determinant of long-term development. Baumol (1990) emphasized that it is not merely the absolute value of resources allocated to various economic activities that matters, but rather the ratio between productive and unproductive expenditures. When the proportion of destructive activities increases relative to productive ones, the long-term prospects for growth diminish significantly. From this perspective, we identify education investment as a productive activity and military spending as a destructive one. In the context of policy formulation, employing Edumilex as an economic policy tool would represent a significant innovation. Traditionally, governments treat education and military spending as separate policy domains when developing strategies. However, this paper contends that such a perspective may be flawed, as both factors significantly contribute to societal levels of peace and stability. This research engages with the normative dimensions of peace economics, as emphasized by Isard (1994), Arrow (1995), Coulomb et al. (2008), and Caruso (2010). To simplify, we advocate for an integrated approach that considers both aspects of public spending together, rather than in isolation, given that they both have profound impacts on long-term peace. We argue that, in establishing a sustainable peaceful society, policymakers must prioritize the allocation of resources to education relative to military expenditures. This approach can help address unforeseen spending demands arising from exogenous events while maintaining internal stability. We posit that the ratio between education and military spending is more significant than the absolute values of each. Therefore, if external threats necessitate an increase in military spending, a corresponding increase in educational funding is recommended to sustain domestic peace levels.

A substantial body of literature, both theoretical and empirical, clarifies how a range of economic opportunities can act as a deterrent to violence, primarily by increasing the opportunity cost of engaging in conflict. While most economists agree on the favorable influence of education on long-term economic growth, existing literature also indicates that military expenditures negatively impact economic development. Consequently, it is reasonable to consider military expenditures and investment in education as countervailing forces that may influence domestic peace trajectories.

The characterization of military spending as a destructive activity is well established and widely accepted among scholars. There exists a robust and interdisciplinary body of literature that highlights how military expenditures and militarization can fuel internal violence, which may manifest as civil strife, state-sponsored violence, repression, and violations of human rights. For instance, Carlton-Ford et al. (2019), drawing on data from 142 countries between 1996 and 2008, show that military expenditures per troop, when measured as a ratio to GDP per capita, are associated with increased child mortality. Dube and Naidu (2015) disclose that US military assistance has exacerbated non-state violence in Colombia, suggesting that such assistance undermines domestic political institutions. Similarly, Vadlamannati and Pathmalal (2010) find that increases in military spending, regardless of whether a country is in a state of war or peace, are detrimental to human rights conditions. Collier and Hoeffler (2006) establish that high military spending in the aftermath of conflict significantly heightens the risk of renewed hostilities. This effect is particularly pronounced in the post-conflict period and tends to intensify over the course of a decade. Moreover, Nafziger and Auvinen (2002) have shown that military centrality—measured by the

ratio of military expenditure to GNP—contributes to humanitarian emergencies characterized by warfare, state violence, and refugee displacement. In addition to discussions regarding the impact of militarization on violence and internal conflicts, a substantial body of literature also focuses on the effects of military expenditures on international conflicts. Notably, as highlighted by Eloranta and Harrison (2015), the lead-up to both World War I and World War II was marked by arms races among rival states in Europe. The seminal work of Richardson (1960) mathematically predicts the instability of arms races, suggesting that they can ultimately precipitate war through a system of differential equations. In a similar vein, Greif (2006) employs a game-theoretical framework to analyze the deterrence equilibrium established in medieval Genoa among rival clans, a system that ultimately became unstable and led to social unrest. Furthermore, Rider et al. (2011) argue that arms races can lead to war, particularly in the context of enduring rivalries between states. Conversely, from an indirect perspective, existing literature consistently demonstrates the negative impact of military expenditures on economic growth, as evidenced by the works of Dunne and Tian (2015), Dunne and Tian (2020), D'agostino et al. (2019), Kollias and Paleologou (2019), and Churchill and Yew (2018).

Within the framework we propose, education investment is identified as a productive form of public expenditure that inherently counterbalances military spending. This argument is predicated on a substantial corpus of extant literature that emphasizes the significance of education for societal development. The impact of education on peace can be understood as both direct and indirect, with the latter implying that economic growth serves as a transmission mechanism for peaceful outcomes. Broadly, we can distinguish two streams of literature analyzing the relationship between education and peace: (i) the indirect effect of education on peace through its influence on economic growth, and (ii) the direct effect of education on mitigating conflicts and crime. Regarding the indirect effect of education on peace, primarily through economic development, there is a nearly unanimous consensus among economists regarding the positive long-term impact of education on economic growth. This is supported by a variety of studies, including those by Hanushek and Woessmann (2020), Marconi (2018), Benos and Zotou (2014), Barro (2013), and Krueger et al. (2001). Concerning the direct effects of education on peace, empirical literature suggests that higher levels of education correlate with a reduced likelihood of violence and a diminished risk of armed conflict. In his influential book, *The Better Angels of Our Nature*, Pinker (2011) identifies education as a critical factor in the long-term reduction of violence. Various studies further support the peace-promoting effects of education, with a substantial body of research exploring its impact on the likelihood of civil armed conflicts. For example, Thyne (2006) emphasizes that higher primary enrollment rates, increased secondary male enrollment, greater expenditure on education, and elevated literacy rates are associated with a decreased risk of conflict. Notably, secondary male enrollment has been linked to a lower risk of initiating civil wars (Collier and Hoeffler, 2004) and shorter conflict durations (Collier et al., 2004). Furthermore, Østby et al. (2019) conduct a comprehensive review of 42 quantitative studies from 1996 to 2016, investigating the relationship between various education measures and political violence, and underscore the intricate, multifaceted nature of pacifying effects of education. In another study, Hegre et al. (2013) incorporates education levels as predictors of armed conflict through 2050, concluding that improvements in education may lead to a minor reduction in the incidence of armed conflicts. There is also a significant body of literature that highlights the negative relationship between education and violent crime, as noted by researchers such as Gil and Ricart (2023), Gleditsch et al. (2022), Rakshit and Neog (2020), Furqan and Mahmood (2020), Rivera (2016), Heckman et al. (2009), Groot and

Brink (2010), Lochner and Moretti (2004), and Grogger (1998). In conclusion, the relationship between education and military expenditure, as they pertain to societal peace, underscores the significance of integrated policy considerations, which can ultimately facilitate the development of more sustainable and peaceful societies.

3.1 Facts, figures and trends of Edumilex

Figure 7 presents the global average of Edumilex between 1980 – 2020 for the 88 countries under consideration. While not incorporated into the subsequent empirical estimations, we provide illustrative data on Edumilex since 1980 to emphasize the significant contrast between the Cold War era and the subsequent years. Educational data were obtained from UNESCO, while military expenditure data were acquired from SIPRI. Due to a substantial number of missing values in the dataset, particularly in the education data, we conducted a Little's chi-squared test to evaluate the assumption of missing completely at random (MCAR) for both the education investment and military expenditure series. The test results indicated a chi-square distance of 20.68 with 2 degrees of freedom. The associated *p-value* was determined to be 0.000, leading us to reject the null hypothesis of missing data occurring completely at random. As stepwise deletion is not considered the optimal approach for addressing non-completely at random missing values, we employed linear interpolation of the education and military expenditure data when computing the variable Edumilex. Unfortunately, the paucity of educational data constrains the inclusion of a greater number of countries in our dataset.

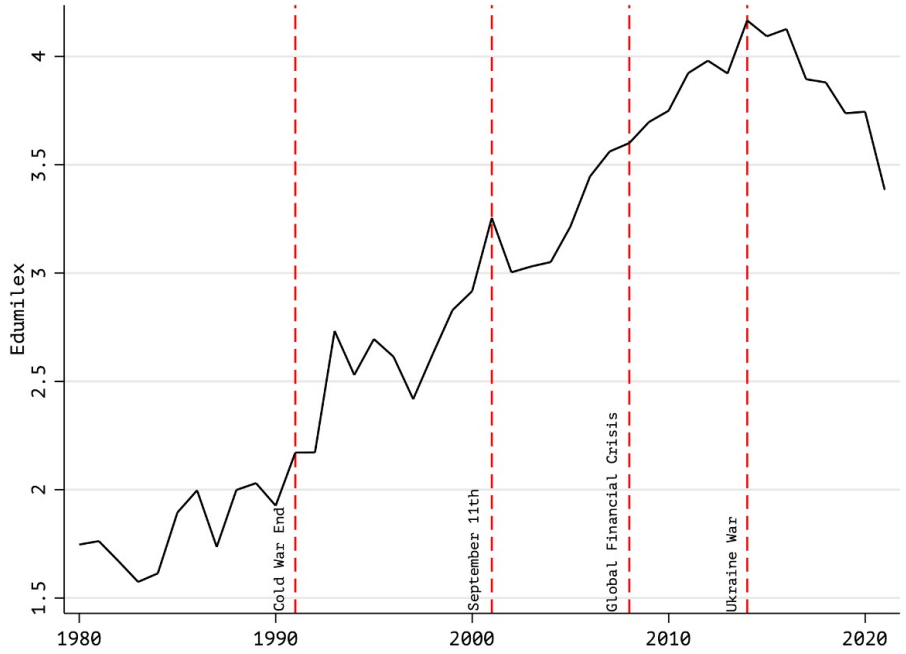

Figure 7: Edumilex - Global Average (1980 – 2020)

The analysis of Edumilex reveals a clear and significant upward trend, particularly in the post-Cold War era. The Edumilex trend provides critical insights into the evolution of public spending priorities across several decades. The minimum recorded value of Edumilex was 1.74 in 1980, with the average level remaining relatively stable at approximately 1.87 from 1980 to 1992. This

period, corresponding to the final years of the Cold War, reflects the persistent global emphasis on military expenditures, often at the expense of investments in education. In this context, the low Edumilex values underscore how geopolitical tensions shaped economic policy decisions, frequently prioritizing defense-related spending over educational investments. As Boulding stated *"No government at the moment has anything remotely resembling a policy for peace. All of them have a policy of defense, but that is something quite different."* (Boulding, 1978). In the subsequent period from 1993 to 2008, a marked increase in Edumilex is observed, with the index's average rising to 2.97. This phase coincides with the immediate post-Cold War years, a period of relative global peace and optimism, during which many countries began to re-evaluate their spending priorities. This shift reflects a gradual reallocation of resources toward education and social development, as governments became more inclined to allocate funds to productive sectors that could drive long-term growth and stability. The increase in Edumilex during this period signifies a shift in the equilibrium between productive and destructive activities, with greater emphasis on sustainable development. The upward trend continued in the most recent period (2009-2020), where Edumilex averaged 3.91. This increase highlights the growing commitment to educational and productive investments as a cornerstone of economic policy in the modern era. The global financial crisis of 2008-2009, along with subsequent economic challenges, prompted governments to prioritize human capital development as a means to support economic recovery. Additionally, international recognition of the role of education in fostering social stability and reducing conflict has further contributed to this upward trajectory in Edumilex values. In total, Edumilex has grown by 114.4% from 1980 to 2020, signaling a profound transformation in the priorities of public spending over the past four decades. However, this positive trend has seen a noticeable reversal beginning in 2014, coinciding with the onset of the Ukrainian war. The outbreak of the conflict in Ukraine not only marked a resurgence of regional military tension but also signaled a broader geopolitical shift that influenced the spending priorities of numerous countries. This period saw an escalation in defense budgets, particularly among countries in Europe and NATO allies, as concerns over security and military preparedness took precedence. Consequently, Edumilex began to exhibit a consistent downward trend from 2014 onward, indicating a gradual shift back toward defense and security spending at the expense of investments in education and other productive sectors. This reversal underscores the rapidity with which international crises can disrupt the equilibrium between productive and destructive expenditures, altering policy priorities in ways that may impact long-term development. More specifically, as previously stated, defense and education policies are typically considered discrete domains, without accounting for the potential synergistic effect they may exert on long-term domestic stability.

In Figure 8, we present the regional trends of Edumilex across world regions. The trends reveal distinct regional trajectories in the ratio between productive and destructive expenditures, reflecting differing historical, economic, and sociopolitical contexts.

For European and Central Asia countries, Edumilex exhibited steady growth over the forty-year period, increasing by 64.12% from 1980 to 2020. The index was at 2.4 in 1980 and attained a level of 4 by 2020. However, it achieved its highest recorded value in 2015 at 4.6, potentially reflecting the continued investment in education and social development in the post-Cold War era, with a peak aligned with European emphasis on peaceful economic integration. Nevertheless, following 2015, this positive trend reversed, and Edumilex experienced an average decline of approximately 3%. This decrease corresponds with the growing regional security concerns precipitated by events such as the Ukrainian conflict and rising geopolitical instability in Eastern Europe, prompting

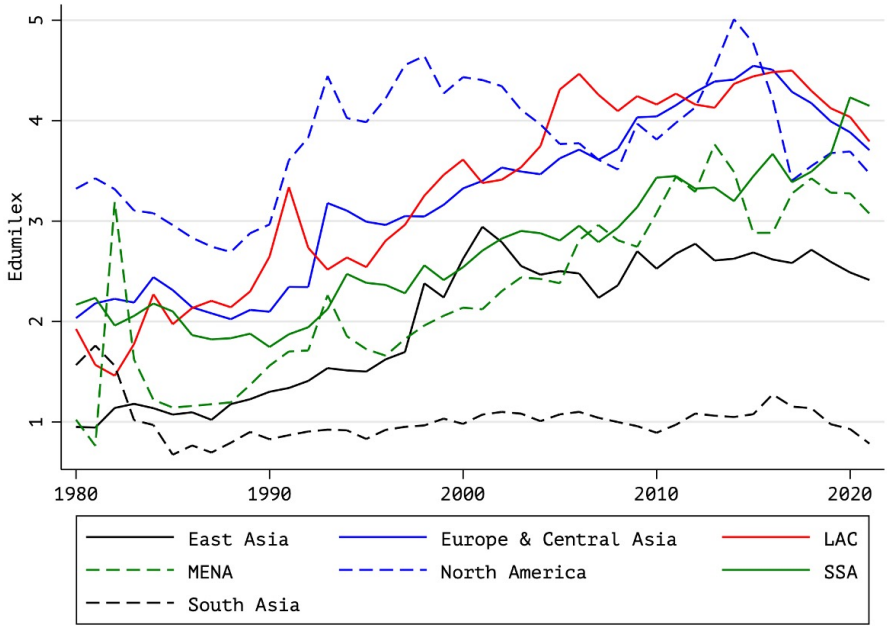

Figure 8: Edumilex - Regional Trends (1980 – 2020)

a renewed focus on defense budgets. In Sub-Saharan Africa, the regional trend for Edumilex demonstrates a more consistent increase over the period, particularly from 1990 onward. In 1990, Edumilex for SSA was recorded at 1.75, and it gradually ascended to reach a peak of 4.2 by 2020. This represents an 82.7% growth rate over the forty-year period. Unlike other regions, Edumilex values in SSA indicate fewer fluctuations. In Latin America and the Caribbean, Edumilex has exhibited the most pronounced long-term growth among the regions considered, increasing by a substantial 240.5% between 1980 and 2020. This growth is particularly significant when examining the period until 2014, during which Edumilex rose by 449.8%, from an initial value of 1.4 in 1980 to its peak at 7.6 in 2014. However, similar to the European trend, Edumilex in Latin America and the Caribbean encountered a turning point post-2014. Following its peak, the index has gradually decreased, reaching 4.7 by 2020.

Figure 9 presents a detailed analysis of the mean Edumilex values across state groups based on income levels, following the World Bank 2020 classification. This categorization explains the ratio between productive and destructive activities in countries at different stages of economic development and how these priorities have evolved over the past four decades.

For high-income countries, the data demonstrates a notably high Edumilex ratio. Between 1980 and 2020, Edumilex in this group increased by 115.32%, rising from an initial value of 1.83 in 1980 to 3.93 by 2020. The peak for high-income countries was reached in 2015 at a value of 4.55, likely influenced by high levels of economic stability that allowed for more significant allocations toward education and social development. However, since 2015, there has been a slight decline in Edumilex, with an annual average decrease of 2.84%. This downward trend may indicate a shift toward increased defense spending. This decrease highlights the competing pressures of sustaining investments in long-term productivity while addressing immediate security needs. In low-income countries, the growth in Edumilex from 1980 to 2020 has been less pronounced, with an increase of only 16.57% over the four decades. The data reveals two distinct periods: from 1980 to 1990, there

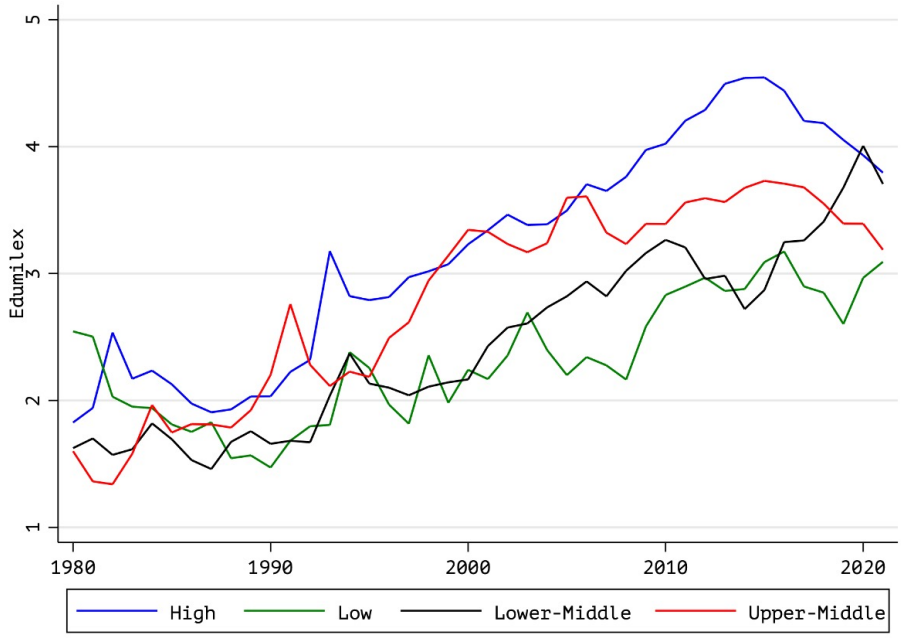

Figure 9: Edumilex by income levels(1980 – 2020)

was a significant decrease in Edumilex by 42.16%, reaching its lowest point of 1.47 in 1990. Since 1990, however, Edumilex has shown gradual recovery, increasing by 76.25% by 2020. Lower-middle-income countries exhibit the most substantial long-term growth in Edumilex, with a remarkable increase of 146.65% from 1980 to 2020. Upper-middle-income countries have also demonstrated significant improvement in Edumilex, with an increase of 112.01% from 1980 to 2020. Starting from a baseline value of 1.6 in 1980, Edumilex reached 3.39 in 2020, just below a peak value recorded in 2019. In conclusion, Figure 9 illustrates that there is an association between income level and Edumilex.

Table 4 presents average Edumilex values across four key periods—1992–2001 (post-Cold War), 2002–2008 (post-September 11th), 2009–2014 (post-2008 financial crisis), and 2015–2020 (post-2014).

Country	Region	Aftermath of Cold War 1992-2001	Post September 11th 2002-2008	Post 2008 Great financial Crisis 2009-2014	Post - 2014 2015-2020
China	East Asia & Pacific	0.97	0.68	0.32	0.23
Indonesia	East Asia & Pacific	1.75	3.81	4.64	4.29
South Korea	East Asia & Pacific	1.2	1.62	1.68	1.75
Germany	Europe & Central Asia	3.27	4.26	4.07	4.19
France	Europe & Central Asia	2.49	2.45	2.37	2.91
United Kingdom	Europe & Central Asia	1.49	1.83	2.24	2.75
Italy	Europe & Central Asia	2.69	2.75	2.93	3.01
Türkiye	Europe & Central Asia	1.07	1.90	2.12	1.96
Argentina	Latin America & Caribbean	2.9	4.61	6.19	6.71
Brazil	Latin America & Caribbean	3.07	2.96	4.07	4.42
Colombia	Latin America & Caribbean	1.23	1.19	1.40	1.45
Iran	Middle East & North Africa	1.02	1.33	1.26	1.70
Israel	Middle East & North Africa	0.81	0.93	0.98	1.14
Saudi Arabia	Middle East & North Africa	0.55	0.75	0.63	0.69
India	South Asia	1.28	1.09	1.29	1.61
Botswana	Sub-Saharan Africa	2.91	3.13	3.73	3.54
Cameroon	Sub-Saharan Africa	1.96	2.27	2.29	2.82
Kenya	Sub-Saharan Africa	3.61	3.47	3.21	3.95
Rwanda	Sub-Saharan Africa	1.27	2.75	3.64	2.77
Tanzania	Sub-Saharan Africa	1.68	4.04	4.1	3.22
South Africa	Sub-Saharan Africa	3.29	3.4	5.0	6.23

Table 4: Average Edumilex figures in selected periods

In East Asia and the Pacific, Indonesia shows a significant increase in Edumilex values, reach-

ing a peak of 4.64 in the post-2008 period, reflecting an intensified focus on productive investment that remains high but stabilizes post-2014 at 4.29. South Korea also maintains a steady upward trend, reaching 1.75 in the most recent period, while China shows a decline, particularly in the 2009–2014 and post-2014 periods. In Europe and Central Asia, Germany consistently shows high Edumilex values, peaking post-September 11th at 4.26, indicating a sustained emphasis on productive spending. Italy also exhibits a gradual rise, reaching 3.01 post-2014, while the United Kingdom and France show an increasing trend, with the UK reaching 2.75 by the latest period. Turkey's values fluctuate, rising sharply post-September 11th but declining slightly to 1.96 in the latest period, suggesting varying spending priorities. Latin America and the Caribbean stand out, with Argentina and Brazil showing sharp increases, particularly after the 2008 financial crisis; Argentina reaches a high of 6.71 in the most recent period. Brazil also climbs, peaking at 4.42, while Colombia maintains more modest growth. In the Middle East and North Africa, Iran and Israel display steady growth in Edumilex values, while Saudi Arabia values remain relatively low and stable across periods India, shows a steady increase from 1.28 post-Cold War to 1.61 in the most recent period. Sub-Saharan Africa displays varying trends, with South Africa experiencing a significant rise in Edumilex, reaching a high of 6.23 post-2014, while Botswana, Cameroon, and Kenya also display upward trends, reflecting a strengthening commitment to productive spending across the continent.

4 The Empirical Model

To test our hypothesis that Edumilex positively affects the Social Peace Index, we conduct an empirical analysis using a panel of 88 countries spanning the period from 1990 to 2020. We estimate the following econometric model:

$$SPI_{it}(log) = \alpha + \beta Edumilex_{it}(log) + \gamma \mathbf{X}_{it} + \delta_t + \mu_i + \epsilon_{it}$$

where SPI denotes the Social Peace Index of country i at time t, Edumilex is the main dependent variable and the vector $\mathbf{X}$ denotes a set of control variables. The control variables encompass indicators of (i) trade openness, (ii) inequality, (iii) employment, (iv) demography, and (v) climate factors that have been demonstrated in the literature to influence peace and conflict. Table 5 provides definitions and data sources for the variables used.

Variable	**Definition**	**Source**
Social Peace Index	Social Peace Index is the geometric mean of Health, Standard of Living, Quality of Institutions and Physical Violence	World Bank; V-Dem
Edumilex	Public Investment in Education/Military Expenditure	UNESCO; Sipri
Trade openness	Exports and imports of goods (% of GDP).	KOF
Gini Index	Gini index measures the extent to which the distribution of income among individuals within an economy deviates from a perfectly equal distribution.	WID
Employment to population ratio (15-24)	Proportion of a country's population (age 15-24) that is employed.	ILOSTAT
Urban population	Urban population refers to people living in urban areas (% total population)	WB
Fertility rate	Number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.	WB
Young male population	Male population between the ages 0 to 14 as a percentage of the total male population.	WB
CO2 emissions (metric tons per capita)	Carbon dioxide emissions in metric tons per capita.	WB
SPEI	The Standardized Precipitation Evapotranspiration Index (SPEI) is designed to take into account both precipitation and potential evapotranspiration (PET) in determining drought.	Global SPEI database

Table 5: Controls - Definition and Sources

Trade openness is quantified as the sum of exports and imports relative to GDP, with data

obtained from the KOF. We control for trade openness, as empirical literature suggests that economic integration can promote internal peace [e.g., de Soysa and Vadlamannati (2021), Magee and Massoud (2011)].

Inequality is measured by the Gini Index, derived from the World Income Inequality Database. Extant literature posits that resource distribution influences social peace by shaping motivations for both grievances and greed, which may precipitate social unrest and diminish overall peacefulness [see, for example, Hillesund and Østby (2023), Ray and Esteban (2017), Cederman et al. (2013), Huber and Mayoral (2019)].

Employment is measured through the employment-to-population ratio for individuals aged 15–24, with data sourced from the World Bank Indicators. Empirical research has demonstrated that youth unemployment is a significant predictor of insurgency and civil conflict [see, among others, Caruso and Gavrilova (2012); Demeke (2022); Urdal (2004)].

Demographic factors are accounted for through three variables: (i) urban population percentage, (ii) fertility rate, and (iii) young male population percentage, all sourced from the World Bank. We utilize the proportion of the urban population relative to the total, as increased urbanization has been associated with social unrest [see, for example, Gizelis et al. (2021), Østby (2016), Fox and Bell (2016), Buhaug and Urdal (2013)]. The fertility rate is also incorporated, as the literature has documented correlations between fertility and conflict, influenced by changes in wealth (Collier et al., 2003), uncertainty (Berrebi and Ostwald, 2015), replacement effects (Kraehnert et al., 2019), and factors such as sexual violence (McGinn, 2000). Additionally, we include young male population data, informed by studies suggesting that societies with a higher percentage of young males may exhibit reduced peace [e.g., Al-Jabri et al. (2022), Acemoglu et al. (2020), Nordås and Davenport (2013), Urdal (2006)].

Furthermore, we incorporate two climate related variables: CO2 emissions, utilized as a proxy for economic development, and the absolute value of Standardized Precipitation Evaporation Index, which functions to capture the potential influence of climate conditions as a driver of conflict (Harari and La Ferrara, 2018; Ide et al., 2021; von Uexkull et al., 2016).

Table 6 presents the descriptive statistics for the variables in our analysis.

Variable	Obs	Mean	Std. dev.	Min	Max
Social Peace Index (log)	2,859	4.164	0.377	2.470	4.592
Edumilex (log)	2,228	1.044	0.802	-1.473	3.536
Trade openness (log)	2,767	3.931	0.385	2.604	4.517
Gini Index (log)	1,244	3.563	0.217	3.030	4.186
Employment to population ratio (15-24) (log)	2,825	3.632	0.364	2.396	4.346
Urban population (log)	2,914	3.949	0.513	1.835	4.598
Fertility rate (log)	2,914	0.902	0.514	0.075	2.054
Young male population (log)	2,914	2.138	0.275	0.619	2.581
CO2 emissions (metric tons per capita) (log)	2,738	0.696	1.614	-3.826	3.864
SPEI (log)	2,826	-0.466	1.038	-8.281	1.192

Table 6: Summary Statistics

A significant concern within our model pertains to the issue of potential endogeneity, which presents the risk of bias and inconsistency in Ordinary Least Squares estimation. Endogeneity may arise from reverse causality, wherein elevated levels of the Social Peace Index in a country potentially lead to increased investments in Edumilex, which could subsequently further enhance the Social Peace Index. To address this critical issue, we employ an instrumental variable IV/2SLS approach to mitigate endogeneity concerns and enhance the robustness of our estimations. The

instrumental variable approach employs an external variable, or instrument, that exhibits correlation with the endogenous explanatory variable while remaining uncorrelated with the error term, thus facilitating the isolation of the causal effect. Specifically, Edumilex is instrumented using two key prices of international commodities: (i) the Food Price Index and (ii) the Metal Price Index. Both education investment and military spending are categorized within the broader domain of public expenditure, and research consistently demonstrates that fluctuations in commodity prices significantly impact business cycles and so also public spending choices. For instance, Benguria et al. (2024) emphasize the relationship between spikes in commodity prices — often driven by industrial demand and global economic conditions — and economic performance. This is particularly relevant for countries that are heavily dependent on exporting these commodities. Similarly, Erten and Ocampo (2013) provide an extensive analysis illustrating how movements in commodity prices are closely linked to macroeconomic conditions. They posit that such price fluctuations can influence various economic factors, including inflation rates, exchange rates, and overall economic policy choices. Their research indicates that a decline in commodity prices can result in diminished fiscal revenues for countries reliant on these exports, thereby affecting their social stability. Furthermore, historical insights from Harris (1935) suggest that a rise in commodity prices—often a hallmark of inflation—may occur if banks do not enhance their support for government bond markets. This situation arises as the Treasury is compelled to borrow funds to finance its recurring deficits. Additionally, a substantial body of literature supports the existence of a relationship between international commodity prices, business cycles, and public spending. Notable studies, such as those by Ginn (2023), and Agénor (2016), along with Lopez-Martin et al. (2019), have documented these intricate dynamics, reinforcing the importance of considering commodity price fluctuations in understanding the broader economic conditions.

5 Findings

In this section, we present the findings of our analysis. Baseline results are presented in Table 7.

Column 1 presents the outcomes of first-stage estimates. The logarithm of both Food Price Index and Metal Price Index exhibits a significant positive association with Edumilex. This suggests that both variables are effective predictors for Edumilex.

Columns 2 to 5 display results of the second stage for various model specifications. Across all specifications, Edumilex consistently demonstrates a positive and statistically significant relationship with the Social Peace Index. Since the model is a log-log specification, coefficients may be interpreted as elasticities. The coefficient of Edumilex is 12.4% which means that a 1% increase in Edumilex is associated with a 12.4% increase in the Social Peace Index. In summary, when the government allocates multiple amounts of dollars to education for each dollar spent on the military, there is an improvement in SPI. This result supports our hypothesis that the ratio between productive and unproductive activities has a direct effect on the peacefulness level of a country. In other words economic policy directly affects domestic peace.

Alongside the outcomes concerning Edumilex, the control variables exhibit the signs previously established in the literature. Specifically, trade openness positively affects SPI: a 1% increase in trade openness is associated with a 13.9% increase in SPI. As anticipated, inequality reduces the level of peacefulness of a country. Specifically, a 1% increase in the Gini index is associated with a 19.5% decrease in the SPI score. Among demographic measures, only fertility rate presents a significant association with the Social Peace Index. Among climate-related variables, CO2 emis-

Dep. Var.	(1) FS Edumilex (log)	(2) 2SLS SPI (log)	(3) 2SLS SPI (log)	(4) 2SLS SPI (log)	(5) 2SLS SPI (log)
Food Price Index (log)	**.476*** **				
	[.064]				
Metal Price Index (log)	**.149*** **				
	[.038]				
Edumilex (log)		**.233*** **	**.170*** **	**.152*** **	**.124*** **
		[.020]	[.039]	[.057]	[.035]
Trade openness (log)			**.115** **	**.154*** **	**.139*** **
			[.046]	[.041]	[.039]
Gini Index (log)			**-.231*** **	**-.228*** **	**-.195*** **
			[.052]	[.051]	[.047]
Employment to population ratio (15-24) (log)			.069		
			[.082]		
Urban population (log)				.066	
				[.105]	
Fertility rate (log)				**.117** **	**.127*** **
				[.052]	[.041]
Young male population (log)				-.014	
				[.044]	
CO2 emissions (metric tons per capita) (log)					**.133*** **
					[.020]
SPEI (log)					**-.007** **
					[.003]
Country FE		Y	Y	Y	Y
Year FE		Y	Y	Y	Y
Cragg-Donald Wald F stat		178.019	47.686	23.005	54.054
Sargan stat p-value		[.589]	[.194]	[.123]	[.434]
Obs	2,214	2,214	985	995	995
Countries	88	88	81	81	81

Robust standard error in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Baseline Results

sions, which can be considered a proxy for economic development, are statistically and positively correlated with the SPI, while the absolute value of SPEI presents a negative elasticity to SPI, suggesting that deterioration of climate conditions affects the level of peacefulness of a country.

5.1 Climate stress and the social foundations of peace

Beyond the core policy coefficient of interest, the baseline estimates also reveal a coherent (and policy-relevant) climatic pattern. In Table 7, CO_2 emissions per capita enter with a positive and precisely estimated coefficient (0.133, $p < 0.01$), whereas the (log) drought/climate-stress indicator based on the absolute value of SPEI enters with a negative elasticity (-0.007, $p < 0.05$). Interpreted in the log–log specification, these coefficients imply that (i) a higher CO_2 level—used here as a proxy for development—is associated with higher levels of social peace, while (ii) more severe hydroclimatic stress is associated with lower social peace.

The positive CO_2 coefficient should not be read as evidence that emissions "cause" peace. Rather, it plausibly reflects the bundle of development-related characteristics correlated with per-capita emissions over the sample period: industrialization, electrification, fiscal capacity, and the provision of public goods. These features map directly into the Social Peace Index domains—health, standards of living, and institutional quality—so CO_2 is best understood as an empirical proxy for the development gradient that strengthens the social foundations of peace. In other words,

it is a control capturing (imperfectly) state capacity and material prosperity, not an argument in favor of higher emissions.

Conversely, the negative SPEI elasticity is the result that speaks most directly to climate stress. By construction, SPEI aggregates deviations in precipitation and potential evapotranspiration (PET), capturing anomalies in water balance that are particularly salient for agricultural productivity, food prices, disease burden, and income volatility. Through these channels, hydroclimatic shocks can erode social peace not only by increasing the risk of unrest and violence, but also by weakening the socioeconomic and institutional inputs that sustain "positive peace" (health outcomes, living standards, and effective governance). This interpretation is consistent with the climate–conflict literature emphasizing how climatic shocks translate into instability primarily in contexts characterized by exposure and vulnerability (rather than through a mechanical, universal effect) (Harari and La Ferrara, 2018; Ide et al., 2021; von Uexkull et al., 2016).

The Sargan statistic tests whether the instruments are valid, meaning they are uncorrelated with the error term and thus exogenous. A high p-value (typically above 0.05) indicates that we fail to reject the null hypothesis of instrument validity, suggesting that the instruments are likely valid and do not introduce bias into the model. In this table, the Sargan p-values across columns are above the 0.05 threshold, suggesting the instruments meet the exogeneity criterion. Cragg-Donald F-statistics evaluates the strength of the instruments. The F-statistic here should exceed the standard threshold (often set at 10) to rule out weak instruments, which could otherwise lead to biased and unreliable estimates. The values in the table (e.g., 178.019 in column (2) and 47.686 in column (3)) are well above the threshold, suggesting that the instruments (the Food Price Index and Metal Price Index) are sufficiently strong predictors of the endogenous variable Edumilex, meeting the relevance criterion. In summary, the high Cragg-Donald F-statistics across models indicate strong instruments, and the high p-values in the Sargan test indicate that the instruments are valid. This combination provides robustness to the IV estimates presented in the table.

To validate our results, Table 8 presents the outcomes of the same models with a modification to one component of the Social Peace. Specifically, we have substituted GDP per capita with GNI per capita. While both GDP and GNI are valuable economic indicators, they serve different purposes and provide distinct insights into the economy of a country. GDP provides a snapshot of the economic activity occurring within a country, while GNI offers a broader view of the income earned by its residents, reflecting their economic well-being.

The estimation results demonstrate minimal changes. The effect of Edumilex on the Social Peace Index remains essentially the same as in Table 7 across all specifications, with negligible changes in the magnitude of the scores. This consistency extends to the control variables, as their coefficients are highly comparable to those of the previous table in terms of significance, size, and magnitude. These results validate the role of Edumilex as an appropriate instrument for economic policy to establish and strengthen social peace. In conclusion, our analysis suggests that when the government allocates a multiple amount of dollars to education for each dollar spent on the military, there is a discernible enhancement in the peacefulness level of the country.

5.2 Robustness Checks

The first robustness check involves examining whether any specific component of the Social Peace Index disproportionately influences the overall results. To investigate this, we regress Edumilex on each individual component of the Social Peace Index. This approach allows us to identify if a

Dep. Var.	(1) FS Edumilex (log)	(2) 2SLS SPI (log)	(3) 2SLS SPI (log)	(4) 2SLS SPI (log)	(5) 2SLS SPI (log)
Food Price Index (log)	**.480*** **				
	[.059]				
Metal Price Index (log)	**.149*** **				
	[.035]				
Edumilex (log)		**.234*** **	**.169*** **	**.154*** **	**.125*** **
		[.021]	[.041]	[.057]	[.034]
Trade openness (log)			**.113** **	**.154*** **	**.139*** **
			[.046]	[.041]	[.039]
Gini Index (log)			**-.239*** **	**-.228*** **	**-.195*** **
			[.051]	[.051]	[.047]
Employment to population ratio (15-24) (log)			.001		
			[.032]		
Urban population (log)				.064	
				[.105]	
Fertility rate (log)				**.116** **	**.126*** **
				[.052]	[.040]
Young male population (log)				-.012	
				[.045]	
CO2 emissions (metric tons per capita) (log)					**.133*** **
					[.020]
SPEI (log)					**-.007** **
					[.003]
Country FE		Y	Y	Y	Y
Year FE		Y	Y	Y	Y
Cragg-Donald Wald F stat		179.537	44.391	23.495	54.914
Sargan stat p-value		[.515]	[.167]	[.128]	[.437]
Obs	2,223	2,223	986	996	996
Countries	88	88	81	81	81

Robust standard error in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Social Peace Index with GNI

particular dimension skews the findings or if the relationships are consistent across all dimensions. The detailed results of this analysis are presented in Table 9.

Dep Var.	(1) 2SLS Health (log)	2 2SLS Health (log)	(3) 2SLS Standard of Living (log)	4 2SLS Standard of Living (log)	(5) 2SLS Quality of Insititutions (log)	6 2SLS Quality of Insititutions (log)	(7) 2SLS Spread of Violence (log)	(8) 2SLS Spread of Violence (log)
Edumilex (log)	**.290*** **	**.150*** **	**.237*** **	**.326*** **	**.111*** **	**.236** **	**.286*** **	**.221** **
	[.017]	.029	[.013]	.059	[.036]	.126	[.040]	[.106]
Controls	N	Y	N	Y	N	Y	N	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F stat	181.344	22.741	178.019	15.139	181.344	22.741	181.344	22.741
Sargan stat p-value	.130	.810	.782	.583	.457	.503	.341	.805
Obs	2,228	1,351	2,214	1,738	2,228	1,351	2,228	1,351
Countries	88	81	88	81	88	81	88	81

Robust standard error in brackets. * p<0.1, ** p<0.05, *** p<0.01.

Table 9: Edumilex and the dimensions of the Social Peace Index

The results significantly validate our expectations. Edumilex demonstrates a positive associa-

	Social Peace Index Low (below the median)		Social Peace Index High (above the median)	
	(1) 2SLS SPI (log)	2 2SLS SPI (log)	(3) 2SLS SPI (log)	(4) 2SLS SPI (log)
Edumilex (log)	**.254*** **	**.116***	**.089*** **	**.050*** **
	[.042]	[.065]	[.005]	[.010]
Controls	N	Y	N	Y
Country FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Cragg-Donald Wald F stat	47.365	13.558	183.705	33.430
Sargan stat p-value	.722	.187	.090	.333
Obs	1,018	323	1,196	655
Countries	48	42	57	47
Robust standard error in brackets. *** p<0.01, ** p<0.05, * p<0.1				

Table 10: Low vs. High SPI

tion with each dimension of the Social Peace Index, and no single component exhibits a disproportionate influence over the others. This finding suggests that the positive relationship between Edumilex and the Social Peace Index is robust across various dimensions. These results support the hypothesis that an higher ratio of both productive and unproductive activities significantly influences each dimension of the Social Peace Index. The absence of a dominant effect of a specific pillar of the SPI indicates that improvements in Edumilex contribute uniformly across different aspects of social peace, reinforcing the concept that social cohesion and stability can be enhanced through a comprehensive understanding of educational investment. Overall, this robustness check highlights the stability and consistency of our primary findings, affirming that the relationship between Edumilex and the Social Peace Index is not contingent on any single factor. By demonstrating that all components play a role in this dynamic, we underscore the interconnectedness of educational investments and social stability.

As a second robustness check, the dataset was divided based on levels of peacefulness to evaluate whether Edumilex functions as a significant policy instrument in both peaceful and less peaceful countries. In this context, peaceful countries are defined as those with a SPI above the median, while less peaceful countries are those with an SPI below the median. The results of this analysis are presented in Table 10.

The findings corroborate the hypothesis that Edumilex is an effective policy instrument for promoting peace in both subsets of countries. In both the above-median and below-median groups, Edumilex demonstrates a positive and statistically significant association with the Social Peace Index. However, a notable difference emerges in the magnitude of the coefficients. Specifically, the elasticity of the SPI with respect to Edumilex is 0.05 in the more peaceful countries, while it is 0.116 in the less peaceful countries.

These results indicate that Edumilex is an effective policy instrument in both categories, but its impact is more pronounced in less peaceful countries. This finding underscores the potential for educational investments relative to military spending to play a crucial role in fostering social stability, particularly in contexts where peace is less established. The stronger effect in less peaceful countries suggests that Edumilex could be particularly beneficial in promoting peace. Thus, this

analysis reinforces the importance of Edumilex as a strategic approach to enhancing social peace across diverse contexts.

6 Conclusion

This paper aims to integrate domestic peace as an objective of economic policy through the proposal of a policy instrument for achieving peace, drawing inspiration from Tinbergen. The main novelty of the study lies in the elaboration and empirical testing of an economic policy for peace rather than an economic policy to reduce violence.

Although a common definition of positive peace is lacking in the literature, we attempt to define it by synthesizing definitions from various scholars. In our perspective, positive peace is a structural feature of a society, and it does not merely concern the absence of violence but necessitates institutional settings that contribute to both reducing incentives for conflict and anticipating violence by fostering an environment for peacefully resolving disputes. We subsequently constructed a target variable measuring social peace, termed the Social Peace Index. This index encompasses four key dimensions: *Health*, *Standard of living*, *Quality of institutions*, and the *Spread of violence*. By synthesizing these dimensions, we aimed to create a comprehensive metric that captures the complex interplay between various aspects of social stability. The identified policy instrument, denoted as Edumilex, represents the ratio between public investment in education and military spending. This innovative framework allows us to explore how the relative allocation of resources between these two critical areas can influence societal outcomes. Through Edumilex, we employ the concept that the ratio between productive and destructive activities is a key factor in the long-term establishment of a peaceful society.

To empirically evaluate this framework, we utilized a panel dataset comprising 88 countries spanning the years from 1990 to 2020. We employed an instrumental variable IV/2SLS estimator to assess the impact of Edumilex on SPI. Our findings consistently demonstrate a positive and statistically significant association between Edumilex and Social Peace Index. The evidence suggests that when governments allocate a greater proportion of public funds to educational investment relative to military spending, there is a notable enhancement in social peace. This correlation emphasizes the potential of educational investment relative to military expenditure not only as a mechanism for economic development but as a foundational element for fostering a peaceful and cohesive society.

While the results affirm the potential of Edumilex as a viable policy instrument for promoting social peace, several important caveats warrant acknowledgment. Firstly, from a theoretical perspective, this paper aligns only partially with aspirations of Tinbergen, as the findings of the study are specifically confined to the context of domestic peace within a political entity, rather than addressing peaceful dynamics between countries. However, the question of how domestic economic policies may influence peaceful relations between states remains open. Future investigations should explore this dimension more thoroughly, particularly in light of existing literature on the relationship between economic integration and global peace. This avenue of inquiry merits further investigation through additional research.

Second, while this study provides a clear relationship between Edumilex and the Social Peace Index, it does not assess the mechanism through which Edumilex affects peace. A plausible interpretation of our findings is that Edumilex may contribute to peace through the transmission mechanism of economic development. A substantial body of literature, both theoretical and em-

pirical, elucidates how a spectrum of economic opportunities acts as a deterrent to violence and as an engine for development. Primary evidence is found in Balestra and Caruso (2022), which posits that a higher Edumilex increased productivity.

Third, more empirical studies are needed to reinforce the relationship between Edumilex and SPI. The study faced limitations due to insufficient education data, which led to the exclusion of several countries from our analysis. To strengthen the robustness and generalization of our findings, future research should aim to incorporate a broader range of countries or focus on specific regions in order to validate both the effectiveness of Edumilex and the magnitude of its effect. Additionally, heterogeneity and non-linearity should also be addressed.

In conclusion, the primary contribution of this study is the evidence-based proposition advocating for the integration of education and military expenditures within economic policy frameworks. This integration is essential due to the collective and substantial impact these investments have on the Social Peace Index. By highlighting the importance of Edumilex, this research underscores the potential for targeted policy measures to foster a more peaceful and stable society. The findings suggest that policymakers should consider the broader implications of their budgetary decisions, recognizing that prioritizing education over military spending can lead to significant long-term benefits for social cohesion and stability.

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