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The Urgency of Conflict Prevention – A Macroeconomic Perspective

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ABSTRACT: Can macroeconomic policy effectively help prevent armed conflicts? This paper contends that two key criteria need to be satisfied: the long-term benefits of prevention policies must exceed the costs associated with uncertain forecasts, and the policies themselves must be directly able to contribute to conflict prevention. This paper proposes policy simulations, based on a novel method of Mueller et al (2024a) that integrates machine learning and dynamic optimization, to show that investing in prevention can generate huge long-run benefits. Returns to prevention policies in countries that have not suffered recently from violence range from $26 to $75 per $1 spent on prevention, and for countries with recent violence, the rate of return could be as high as $103 per $1 spent on prevention. Furthermore, an analysis of the available data and results in the literature suggest that sound macroeconomic policies and international support for these policies can play key roles in conflict prevention. Based on these findings, this paper proposes actionable recommendations, for both global and domestic policymakers as well as international financial institutions and multilateral organizations, to promote peace and stability through macroeconomic policy.

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WORKING PAPERS

The Urgency of Conflict Prevention – A Macroeconomic Perspective

Prepared by Hannes Mueller, Christopher Rauh, Benjamin Seimon, and Raphael Espinoza [1]

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Contents

1. Introduction

With Fragile and Conflict-Affected States (FCS) home to nearly 1 billion people and half of the world's people living in extreme poverty, engagement in FCS is increasingly important for the international community. Both the World Bank and the IMF have recently developed specific strategies to guide their work in these countries, supported by resources and arrangements to their toolkit. However, whereas it has long been understood that sound macroeconomic policies reduce the frequency of economic crises, it is not clear whether they should also be used to address the risk of armed conflict. Existing work has stressed the effect of macroeconomic shocks on the risks of conflict (Leepipatpiboon, Castrovillari and Mineyama 2023) as well as the importance of macroeconomic policy in escaping the conflict trap (Chami, Coppo, Espinoza and Montiel 2021a; Rohner and Thoenig 2021). However, the specific role that macroeconomic policy could play in conflict prevention has received much less attention. As a result, policy tends to adapt to the realities of ongoing and past conflict rather than anticipate it, and in some cases may contribute to raising conflict risks.

In this paper, we make the argument that macroeconomic policy can play an important role in armed conflict prevention. From an economic perspective, prevention encompasses a set of policies, programs, and projects that help strengthen institutions, promote inclusive economic growth, and support local community development – thereby reducing fragility and conflict risks (United Nations and World Bank, 2018). Making the prevention of armed conflict an objective for macroeconomic policy faces two important challenges. First, assessing the likelihood of conflict in peaceful countries is hard (Mueller and Rauh 2022a). Although advancements in forecasting techniques can help policymakers identify *fragile* settings, it is a priori unclear whether accounting for these relatively low risk scenarios is warranted when setting macroeconomic policy. Second, it is also an open question as to how macroeconomic policy can help reduce the risk of conflict. What are the policy levers that should be pulled? What effects do they have on the risk of violence and on the economy? Answers to these questions are hard to give, but we provide evidence that indicates huge potential for both fiscal policy and for international community engagement and support, as captured by approval of IMF programs.

Our analysis starts with an overview of the existing literature that highlights the dramatic economic costs associated with armed conflict. These are incurred whilst violence is ongoing, but we also argue the costs are amplified when accounting for the losses in the years after the initial onset of conflict because of recurring cycles of violence, i.e., the "conflict trap".[1] We then present the quantitative model of decision making of Mueller, Rauh, Ruggieri and Seimon (2024a) that integrates the conflict trap. The model allows to solve a prediction policy problem in which forecasts and policy analysis are both critical elements of good policymaking (Kleinberg, Ludwig, Mullainathan and Obermeyer 2015). The model integrates forecasting and decision-making by modelling the dynamics of conflict risk through different conflict risk stages.

[1] We discuss the relationship between fragility and conflict in Section 3.1

Figure 1 shows a simplified version of the conflict risk stages model in which we distinguish low risk, high risk with little/no violence, high risk with recent violence, and high violence stages.[2]

The arrows in the Figure indicate the likelihood that one stage follows another at the quarterly frequency. For example, if a country starts in a stage of *Very low risk* it has a likelihood of 97% to remain in that stage next quarter, a 2% likelihood of transitioning to *High risk* with little or no recent violence and an extremely small likelihood of transitioning to any of the other two stages (arrows not shown). However, once in stage of *High violence* countries cannot directly return to *Very low risk* but need to first transition through the stages of *High risk*. This is the essence of the conflict trap.

Figure 1: A Simple model of conflict dynamics

Notes: The Figure shows a simplified version of the conflict dynamics model estimated from the predictions available at Mueller and Rauh (2023) in a Hidden Markov Model. Likelihoods of less than 1% are not shown.

The complete framework links these conflict risk stages with data on damages in terms of economic losses (GDP), fatalities, displacement, and humanitarian aid. Policies are then modeled as costly manipulations of the arrows in Figure 1. This provides a way to trade-off the conflict trap and the devastating effect it has on macroeconomic indicators against the costs of engaging in prevention. The framework therefore directly addresses a key challenge faced by policymakers in fragile contexts: the benefits that prevention yields are uncertain as conflict risks do not always materialize, and the possible actions they can take are limited by the immediate and strong resource constraints.

We show that, due to the huge economic costs of the conflict trap, successful prevention has high benefits when including the dynamic impacts, helping to avoid both the costs of conflict onset as well as

[2] We thank Gary Milante (Stockholm International Peace Research Institute) for proposing this visualization of conflict risk stages.

the costs of future cycles of violence and intervention. We find that returns to prevention policies in countries that have not suffered recently from violence range from $26 to $75 per $1 spent on prevention, and for countries with recent violence, the rate of return could be as high as $103 per $1 spent on prevention. For comparison, prevention policies in *High violence* countries has a return of $27 per $1 spent.

We then demonstrate that certain domestic macroeconomic policies, with international support, can play the role of prevention policies, reducing the risk of conflict (i.e., changing the probabilities represented by the arrows in Figure 1) at reasonable costs. We produce three main findings:

- *First, healthier fiscal positions and improved state capacity are important elements of prevention*. Even when controlling for country characteristics, our empirical model of conflict risks shows that the risk of conflict falls with a higher fiscal balance, although conflict risk increases following expenditure cuts. This implies that efforts to improve the fiscal balance should not come at the expense of productive expenditures, and that increasing revenues will be particularly valuable. Indeed, revenue mobilization has been an important objective of international support in the form of capacity development, as explained in e.g., Baer, Gupta, Mansour and Pattanayak (2021).
- *Second, a resilient economy, in particular a resilient labor market, is invaluable for mitigating conflict risks.* We find that when unemployment is higher, the likelihood and intensity of violence increases. Indeed, a healthy labor market increases the opportunity cost of picking up arms.
- *Third, international engagement can support the slow build-up of state capacity.* We show that IMF programs tend to occur in stages of high conflict risk and that, after controlling for the endogeneity of IMF interventions, programs lead to reductions in the likelihood of violence by 1.5–4 percentage points on average.

These findings are broadly in line with the conflict literature.[3] A strong fiscal position contributes to political stability by enhancing the capacity of the state to provide essential services, including security, which deters challenges to the government. It also provides financial space to policymakers to mitigate the impact of shocks on populations, possibly reducing tensions (Leepipatpiboon et al. 2023). Additionally, economic policies in resource-rich countries must consider the risk of conflict, as exemplified by the link between mining activities and social unrest. This may require macroeconomic strategies that foster both economic and political inclusiveness, to sustain peace and stability. In short, effective macroeconomic policy must ensure long-term stability by aligning fiscal policy with peace maintenance, acknowledging that economic gains are unsustainable if they jeopardize peaceful equilibria between opposition and state entities (Fearon 1994; Cheng, Goodhand and Meehan 2018; Blattman 2022). A caveat is that these findings do not distinguish between the sources of conflict risk, which may come from different external or domestic actors, including in some cases from withing the government itself.

We also find that international engagement has reduced the likelihood of conflict, but our analysis suggests that there are additional gains to reap if more attention is paid to prevention in non-violent

[3] For recent reviews see Ray and Esteban (2017), Mueller, Piemontese and Tapsoba (2017), World Bank (2018), Chami, Espinoza and Montiel (2021b) and Rohner and Thoenig (2021).

situations, not considered as fragile according to the World Bank-IMF list of Fragile and Conflict-Affected Situations (FCS list), but which can nonetheless be considered as high risk. In particular, 77% of high-risk countries with recent violence were not on the FCS list, indicating a need for more nuanced risk assessment, in order to avoid overlooking areas of potential violence. Effective prevention will require addressing such fragility in policy design.

The remainder of this paper is structured as follows. Section 2 provides an overview of the costs of armed conflict and its main drivers, with a focus on the macroeconomic damage imposed by armed violence. Section 3 then defines our conceptual lens; the conflict risk stages model. Section 4 discusses why, in this context, prevention should become a policy priority even if based on highly imperfect forecasts. In Section 5 and 6 we then turn toward macroeconomic policy and IMF support for these policies in light of the conflict risk stages framework. The final section presents implications of our findings for international and domestic policymaking institutions.

2. The Catastrophic Consequences of the Trap

In this section we discuss the macroeconomic costs of conflict. Since the volume of Chami, Espinoza and Montiel (2021b) discusses many of the macroeconomic aspects in detail (e.g. fiscal capacity, monetary and exchange rate regime, aid effectiveness, financial development), this section does not aim to provide a complete overview. Instead, we highlight the role played by the conflict trap as this motivates a preventative approach. Armed conflict affects economic conditions both when it is occurring, and in the aftermath. We start our analysis by exploring the first stage, i.e. the relationship between violence and economic activity during conflict. We then turn toward the costs of the aftermath of conflict.

The macroeconomic impact of armed conflict has been studied extensively. Collier (1999) analyzed the effects of violence on GDP growth using cross-county data on internal wars which occurred between 1960 and 1992. He found that civil conflict is correlated with a contemporaneous reduction of GDP per capita growth of 2.2%. Cerra and Saxena (2008) follow up on this study and find similar results.[4] At the regional level, Abadie and Gardeazabal (2003) investigate the economic effect of the Basque terror campaign and estimate it reduced per capita GDP by approximately 10%. These strong local effects are confirmed by Mueller (2016), who explains that this is an argument for a per-capita measurement of violence intensity when studying the macroeconomic damage of armed conflict.

Armed conflict leads to the loss of lives and causes the destruction of resources that would have been employed in production. Armed conflict has also far-reaching implications for those who survive and has multi-generational impact, with lost years of schooling and mental scars. These directly impact contemporaneous economic performance in the affected territory and also affect recovery. It can also cut regions off from transport networks (Amodio and Di Maio 2014). This triggers strong spillovers across production networks. Blomberg and Hess (2006) argue that the presence of violence is equivalent to a

[4] Refining their method, Mueller (2012) shows that armed conflict is the most harmful type of crisis studied by Cerra and Saxena (2008).

30% tariff on international trade. Martin, Mayer and Thoenig (2008) estimate conflict reduces trade by 20 –25%. Couttenier, Monnet and Piemontese (2022) show that spillovers into the production network generate over 70% of the total economic damage from conflict. In fact, countries needn't be involved in full-scale civil war to be impacted by conflict. Recent analysis suggests that persistent, negative media reporting on a country following the deaths of foreigners can effectively cut off travel from other countries (Besley, Fetzer and Mueller 2023).

With the public sector changing its focus under the pressure of power competition, resources are also diverted from productive use. Collier et al. (2003), for example, show that during civil wars countries increase their military expenditure from 2.8 to 5% of GDP. In the long run, fiscal revenues can also be affected. This is most obvious in circumstances where the government loses control over territory but Besley and Persson (2011a) also show that fragile political power will lead to under-investment in fiscal capacity—which leads to low revenues in the long run. The private sector may also divert its resources to substitute for the missing provision of public goods by the public sector, such as security and infrastructure (Assaf, Engman, Ragoussis and Agrawal 2021).

Most recently, the literature has turned towards the importance of the conflict trap as a concept to understand the costs of conflict. Mueller and Rauh (2022a) argue that modeling the high risks of future conflict after the end of a conflict episode is a good way to capture the conflict trap. Margalef and Mueller (2023) show that trap dynamics can explain a relative GDP per capita decline of around 50% for the worst affected countries. In a recent summary paper, Rohner and Thoenig (2021) highlight the existence of several types of war traps in which political and economic dynamics reinforce each other. Policies must therefore be calibrated to address jointly both poverty and social tensions. In other words, macroeconomic policies should not be seen in isolation or as merely a technical question, a point also made by Chami et al. (2021a). They need to be planned in the broader conflict context—this is crucial in fragile countries which are escaping conflict.[5] There is thus a strong complementarity between peace and development objectives.

A key aspect of policy in this context is the influence it has on expectations. Armed conflict generates fear of the future and, in this way, destroys the incentives to invest in human and physical capital. Even the risk of impeding political violence can trigger economic uncertainty which throttles the economy (Bloom 2009; Baker, Bloom and Davis 2016; Garcia-Uribe, Mueller and Sanz 2024). It has also been shown that the anticipation of violence distorts the economy and lowers asset prices, amplifying the human and economic cost of violence (Besley and Mueller 2018; Besley and Mueller 2012; Tapsoba 2023 Elster, Zussman and Zussman 2017). Chami et al. (2021a) thus argue that the conflict trap reinforces the well-known poverty trap, by increasing risk premia, lowering savings and investment, increasing fixed costs, and worsening the resource trap. This is where external organizations like the IMF can play an important role. External evaluations and engagement can shift perspectives by coordinating expectations on a

[5] For different, influential perspectives on this see Besley and Persson (2011b), Collier (2021), Ray and Esteban (2017) and Rohner (2024).

better equilibrium (Collier 2021) and, in this way, have rapid effects that can reach beyond the narrow economic dimension they target.

3. A Quantitative Representation of the Conflict Trap

3.1 The stages of conflict

We now turn to a quantitative representation of the conflict trap. The data used to measure conflict is that of the Uppsala Conflict Data Program (UCDP), which defines conflict as a contested incompatibility, that concerns a government or territory, where the use of armed force between two parties (one of them the government) results in at least 25 battle related deaths in a calendar year.[6] We choose the UCDP because of its long time series, with available violence data from 1989 to today for all countries. The UCDP also provides so-called candidate data for fatalities for the most recent data which are updated monthly, and which we treat as true UCDP fatality observations. We incorporate all kinds of conflict fatalities coded by the UCDP.

It is important to keep in mind two empirical and conceptual caveats that underpin the analysis. First, our focus on the UCDP data provides a particular view on conflict which follows the aforementioned UCDP definition of armed conflict, also discussed in detail in Sundberge and Melander (2013) and Croicu and Sundberg (2016). This includes, for example, gang-related fatalities in Latin America and the Caribbean, but excludes homicides more generally and ignores other types of events like riots measured by the Armed Conflict Location & Event Data (ACLED).[7] However, since organized violence as measured by UCDP has been shown to be strongly correlated with macroeconomic outcomes (see section 2), it is particularly relevant to assess the importance of macroeconomic policy for prevention. It is also worth stressing that UCDP events mostly capture internal armed conflicts. However, the division line is not always clear and in some cases, there are clearly defined external actors involved in the violence tracked by UCDP.

Second, our analysis assumes that estimating conflict risk is equivalent to ascertaining the extent to which a country is exposed to fragility. Fragility is a multidimensional concept reflected in political, economic, human, environmental, societal and security-related factors. (OECD, 2022). While its manifestations are unique to each context, most fragile countries struggle to provide public goods such as security and rule of law, face active contestation by some groups in society, and are subject to elite capture or corruption rendering them unable to deliver on the social contract. These features elevate risks of violence (United Nations and World Bank, 2018). Therefore, to derive measures of fragility, we forecast both the intensity of conflict per capita and the likelihood of an outbreak in peaceful countries. This implies that our model is able to track the entire continuum of fragility from countries which are in stable peace to

[6] Data on battle deaths comes from Sundberg and Melander (2013).
[7] See Raleigh et al (2023).

countries suffering from open violence. To make this possible we need to summarize several independent forecasts in one larger model.

Each of the *ConflictForecast* sub-models[8] developed by Mueller and Rauh (2022a) uses the UCDP data and information from close to 6 million newspaper articles to provide pseudo-out of sample forecasts for the risk of conflict outbreak a year into the future, by using the information set at a time T. The forecasts are generated by training a Random Forest to learn a functional form using all data from January 1989 to December 1999 as follows[9]:

$$y_{i,T<t\leq T+W} = F_T(\mathbf{X}_{i,T}),$$

for a period T and window W. With the resulting model, we then produce out of sample predictions on a rolling basis from January 2000 onwards:

$$\hat{y}_{i,T<t\leq T+W} = F_T(\mathbf{X}_{i,T}),$$

Following the methodology from Mueller et al. (2024a) these forecasts are then aggregated using a Hidden Markov Model (HMM) to estimate what we call the conflict risk stages.[10] This is a probabilistic generative model, in which a sequence of observable variables O (i.e. the forecasts) is generated by a sequence of internal hidden states Z.[11] The transitions between hidden states are assumed to have the form of a (first-order) Markov chain. They can be specified by the start probability vector π and a transition probability matrix A. In order to have a useful HMM for a real applications, there are three basic problems that must be solved:

1. *Likelihood*: Given an HMM λ = (π, A, B) and an observation sequence O, determine the likelihood P (O|λ).)
2. *Decoding*: Given an observation sequence O and an HMM λ = (π, A, B), discover the best hidden state sequence Z.
3. *Learning:* Given an observation sequence O and the set of states in the HMM, learn the HMM parameters λ.

The first and the second problem can be solved by the dynamic programming algorithms known as the Viterbi algorithm and the Forward-Backward algorithm, respectively. The last one can be solved by an iterative Expectation-Maximization (EM) algorithm, known as the Baum-Welch algorithm. The state-space of the HMMs is discrete, hence the key hyperparameter is the number of states. This is determined

[8] See also https://conflictforecast.org/

[9] Further details about the prediction methodology can be found in Mueller and Rauh (2022b); Mueller et al. (2024b).

[10] We rely on the Python package PyHHMM for implementation.

[11] Specifically O is made up of the 12 month ahead outbreak risk forecasts from the best (historical violence and text features) and text-only models, 12 month ahead intensity forecast and a polynomial of degree three describing the predicted risk of conflict re-emergence using the months since the last armed conflict. The latter input reinforces the high risk in the months following armed conflict that decays exponentially but then stays relatively high for several years.

through experimentation and ad-hoc judgement such that we are able to distill the cycle of peace and conflict into a spectrum of distinct risk stages. Conflict stages are a way to make conflict dynamics and conflict damages intuitively understandable, but they are not directly observed.

Using this method, every country is assigned to a stage for every month in the period January 2000 to April 2023. It is easiest to think of the stages as summaries of situations across the cycle of peace and conflict that have occurred in the past. Table 1 presents a descriptive statistical summary.[12] The first two columns report averages of the predicted likelihood of armed conflict and of the intensity of violence (fatalities per one million inhabitants). The third column reports the average realization of deaths. The fourth column reports the average number of months since the last armed conflict episode. The fifth column reports the total count of country/month observations by stage. Later in this section we also demonstrate that these stages are a way to characterize predictable trajectories of armed conflict via a transition matrix.

In stages 1 to 4 the forecasting model predicts very few fatalities resulting from conflict and a low risk of a future escalation or outbreak. This is reflected in the realizations where deaths per capita are 0 on average when a country is in one of these stages. For example, many advanced economies have spent the entire sample timespan in conflict risk stages 1 or 2.

Stages 5 and 6 generally capture countries that have been peaceful for years but have elevated risks of an armed conflict outbreak (as per the first column of Table 1). Stages 7 to 10 show increased risk driven by recent experience of violence and susceptibility to recurrence. Both forecasts for the risk of an outbreak and the intensity of violence are significantly elevated in these post-conflict stages 7 to 10, compared to stages 1 to 4. It is important to note that the ranking of stages is derived from the dynamic summary of the likelihood of conflict and number of fatalities within the HMM. Stages rank higher if they are more likely to escalate into the destructive stages 11 and 12.[13]

[12] Note that the values in this table simply represent the mean value across observations conditional on the stage, which could be driven by outliers. Strictly, they are in fact represented by a distribution of values conditional on the stage. Figures showing these distributions can be found in Appendix A.

[13] The ranking between stages 9 and 10 therefore also provides a cautionary tale for relying on intensity forecasts alone. In small data situations, this can miss important escalation risks as suggested by the extremely high escalation risk of stage 10.

Table 1: Descriptive summary of risk stages

Stage	Predicted likelihood of armed conflict outbreak	Predicted number of fatalities (per 1mn inhabitants)	Observed number of fatalities (per 1mn inhabitants)	Number of months since last armed conflict episode	Share of observations (%)
1	0.99	0.09	0	271	27.1
2	2.63	0.15	0	228	19.2
3	6.96	0.16	0	112	12.5
4	14.02	0.11	0	106	7.3
5	19.89	0.55	0	57	6.5
6	15.39	1.17	0	80	3.7
7	39.00	0.26	0	11	5.4
8	41.61	6.93	2	33	1.1
9	57.12	14.28	0	9	2.1
10	75.67	1.95	0	3	5.6
11	85.33	6.67	6	0	8.1
12	85.26	54.30	71	0	1.3

Notes: The predictions are derived from Mueller and Rauh (2023) and the battle deaths from the UCDP.

Stages 11 and 12 represent ongoing violence. Hence, the outbreak forecast is high but uninformative here. Instead, these two stages are differentiated by the intensity of conflict. On average, a country experiences 6 deaths per 1 million inhabitants when in stage 11, compared to 71 deaths per 1 million when in stage 12. For example, Mexico has spent extended periods in stage 11 (due to homicides associated with organized crime), whilst Afghanistan, Syria and the Central African Republic suffer most frequently from being in stage 12.

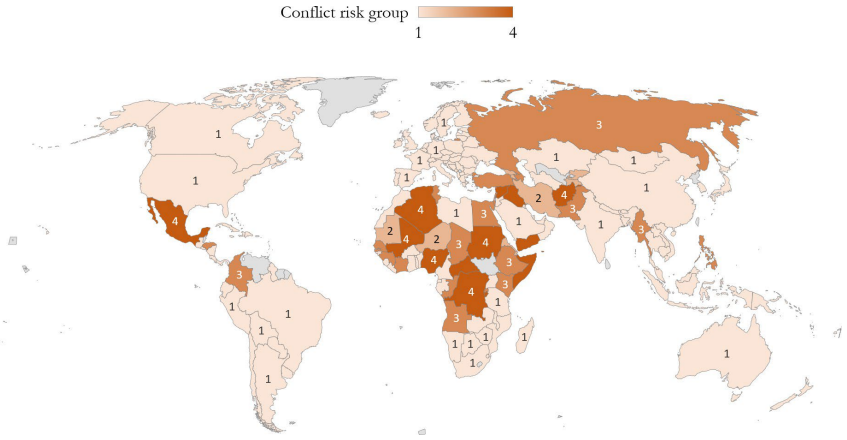
For ease of presentation, we summarize these 12 stages in Table 1 into four groups of *Very low risk* (stages 1 to 4), *High risk with little or no violence* (stages 5 and 6), *High risk with recent violence* (stages 7 to 10), and *High violence* (stages 11 and 12). These definitions are not strict. Technically speaking, not all countries in the *High risk* with recent violence group are coming out of conflict. Some of them could have a very high risk forecast without having experienced armed conflict. However, this is rare and the great majority of countries facing high risk had a recent conflict.[14]

Figure 2 shows a snapshot of the distribution of groups across the world using these four categories. In Figure 2, groups are stable and constructed according to which conflict stage countries started most

[14] 98% of observations in stages 7-10 experienced armed conflict within the last 3 years. An example of an exception is Lebanon, in stage 8 from March 2005 to March 2006.

semesters in the period 2000-2023.[15] Countries in group 1, for example, started most semesters in stages 1 to 4, whereas countries in group 3 started most semesters in stages 7 to 10.

Figure 2: Map of conflict risk groups (across four groups), 2000 to 2023



To analyze returns to prevention policies in emerging and developing economies, we narrow the sample of countries to those falling below the 75th percentile based on GDP per capita. In Table 2 the full sample and stage visit history for these countries is shown. The Table illustrates how conflict risk stage models allow policymakers to categorize country histories quickly.

[15] We use data at the semi-annual frequency to align with the data granularity of the IMF World Economic Outlook which is used to analyze macro-policy shocks later in this paper.

Table 2: Number of months spent in a conflict risk stage, Jan 2000 to Apr 2023

(a) Bottom 37.5%, GDP per capita

Stage	1	2	3	4	5	6	7	8	9	10	11	12
Afghanistan	0	0	0	0	0	0	0	0	2	2	168	108
Angola	0	0	39	39	19	21	96	0	11	24	31	0
Burundi	0	0	0	0	37	0	7	6	17	80	77	56
Benin	0	116	34	108	6	2	10	4	0	0	0	0
Burkina Faso	0	57	29	93	3	0	24	11	4	6	49	4
Bangladesh	0	0	60	197	23	0	0	0	0	0	0	0
Bolivia (Plurinational State of)	21	105	97	16	15	13	10	0	0	3	0	0
Bhutan	130	57	86	6	0	1	0	0	0	0	0	0
Central African Republic (the)	0	0	0	0	8	1	0	1	38	54	105	73
Côte d'Ivoire	0	0	5	48	74	0	18	27	28	53	27	0
Cameroon	0	18	65	64	23	0	4	2	0	4	94	6
Congo (the Democratic Republic of the)	0	0	0	0	0	0	0	0	5	56	215	4
Congo (the)	0	0	11	89	26	0	51	6	36	46	15	0
Comoros (the)	13	133	64	0	3	54	0	13	0	0	0	0
Djibouti	0	0	72	0	67	97	6	8	24	5	1	0
Eritrea	0	0	61	14	108	2	6	20	64	0	3	2
Ethiopia	0	0	0	0	16	0	25	5	10	134	84	6
Ghana	0	38	157	22	0	2	49	2	0	9	1	0
Guinea	0	0	7	75	58	10	78	7	5	32	8	0
Gambia (the)	0	31	71	18	44	104	0	9	0	3	0	0
Guinea-Bissau	0	54	88	0	39	79	0	13	5	2	0	0
Honduras	0	0	29	56	6	22	152	5	2	8	0	0
Haiti	0	26	96	12	29	8	50	7	0	40	12	0
India	0	0	28	165	42	0	43	2	0	0	0	0
Kenya	0	0	0	0	2	0	58	2	11	148	59	0
Kyrgyzstan	0	0	26	0	162	24	19	4	29	13	3	0
Cambodia	0	26	101	89	27	8	17	12	0	0	0	0
Lao People's Democratic Republic (the)	6	78	107	35	15	2	23	2	6	6	0	0
Liberia	9	48	72	48	42	0	0	0	29	0	13	19
Morocco	0	36	47	152	20	1	23	1	0	0	0	0
Moldova (the Republic of)	18	124	0	0	0	138	0	0	0	0	0	0
Madagascar	0	13	31	153	17	1	49	5	0	11	0	0
Mali	0	0	7	33	9	6	57	8	6	35	111	8
Myanmar	0	0	0	0	0	0	0	0	13	147	120	0
Mozambique	0	0	45	89	15	14	59	6	0	2	50	0
Mauritania	0	0	85	8	115	30	32	2	5	3	0	0
Malawi	4	208	39	25	3	0	0	1	0	0	0	0
Niger (the)	0	0	7	26	100	0	29	6	2	38	72	0
Nigeria	0	0	0	0	0	0	24	1	4	88	163	0
Nicaragua	62	205	5	2	0	6	0	0	0	0	0	0
Nepal	0	44	74	33	19	0	0	4	15	24	67	0
Pakistan	0	0	0	0	66	1	48	13	13	45	94	0
Philippines (the)	0	0	0	0	6	6	14	0	19	145	90	0
Papua New Guinea	0	0	112	60	0	25	35	7	9	25	7	0
Rwanda	0	0	0	65	99	5	54	4	35	14	1	3
Sudan (the)	0	0	0	0	0	0	0	0	14	35	224	7
Senegal	0	0	40	70	0	0	98	8	7	44	13	0
Sierra Leone	4	104	55	36	33	0	0	6	16	11	7	8
Somalia	0	0	0	0	0	0	0	0	6	12	192	70
South Sudan	0	0	0	0	0	0	1	0	6	12	118	5
Syrian Arab Republic	0	7	15	0	71	40	0	2	0	0	44	101
Chad	0	0	0	15	32	3	9	5	41	98	76	1
Togo	6	26	103	7	55	43	1	12	22	3	0	2
Tajikistan	0	0	1	6	177	29	21	5	39	0	2	0
Timor-Leste	95	44	73	0	20	7	14	0	0	0	0	0
Tanzania, United Republic of	0	6	89	119	35	0	24	1	0	6	0	0
Uganda	0	0	0	117	12	0	23	5	13	38	72	0
Ukraine	57	94	17	0	3	0	0	0	0	45	49	15
Uzbekistan	0	52	84	0	89	6	35	1	12	0	1	0
Viet Nam	161	119	0	0	0	0	0	0	0	0	0	0
Yemen	0	0	11	7	63	6	28	10	3	5	123	24
Zambia	14	117	100	5	22	1	21	0	0	0	0	0
Zimbabwe	0	10	135	51	55	9	13	1	0	6	0	0

(b) 37.5% to 75%, GDP per capita

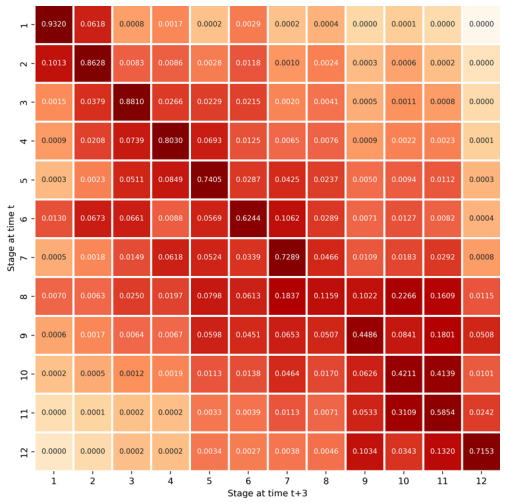
Stage	1	2	3	4	5	6	7	8	9	10	11	12
Albania	3	166	66	0	37	0	8	0	0	0	0	0
Argentina	179	51	50	0	0	0	0	0	0	0	0	0
Armenia	0	0	40	0	31	112	63	9	2	23	0	0
Antigua and Barbuda	265	12	0	0	0	2	0	1	0	0	0	0
Azerbaijan	0	0	0	0	75	21	82	14	40	40	4	4
Bulgaria	157	123	0	0	0	0	0	0	0	0	0	0
Bosnia and Herzegovina	0	142	50	9	29	47	0	3	0	0	0	0
Belarus	55	194	11	0	14	6	0	0	0	0	0	0
Brazil	0	12	166	16	0	6	9	3	6	34	28	0
Barbados	280	0	0	0	0	0	0	0	0	0	0	0
Botswana	92	185	22	0	0	1	0	0	0	0	0	0
Chile	129	151	0	0	0	0	0	0	0	0	0	0
China	27	161	92	0	0	0	0	0	0	0	0	0
Colombia	0	0	0	0	0	0	43	5	0	102	130	0
Costa Rica	270	10	0	0	0	0	0	0	0	0	0	0
Cuba	210	70	0	0	0	0	0	0	0	0	0	0
Dominica	280	0	0	0	0	0	0	0	0	0	0	0
Dominican Republic (the)	119	138	12	11	0	0	0	0	0	0	0	0
Algeria	0	0	0	12	34	0	35	1	0	75	123	0
Ecuador	0	3	172	32	8	16	28	4	0	12	5	0
Egypt	0	0	18	80	24	0	64	10	6	52	26	0
Fiji	135	113	17	0	0	15	0	0	0	0	0	0
Gabon	16	223	35	0	0	5	0	1	0	0	0	0
Georgia	2	37	49	0	47	95	0	15	34	0	0	1
Equatorial Guinea	56	188	0	0	0	36	0	0	0	0	0	0
Grenada	240	23	0	0	0	14	0	3	0	0	0	0
Guatemala	0	0	72	103	23	13	67	2	0	0	0	0
Guyana	83	71	65	0	0	49	0	6	0	6	0	0
Croatia	77	138	6	0	0	59	0	0	0	0	0	0
Hungary	219	61	0	0	0	0	0	0	0	0	0	0
Indonesia	0	0	74	120	0	0	29	0	0	45	12	0
Iran (Islamic Republic of)	0	0	0	0	212	0	30	7	7	24	0	0
Iraq	0	0	0	0	0	0	0	0	7	32	222	19
Jamaica	109	14	81	0	0	22	0	31	23	0	0	0
Jordan	0	69	93	37	43	2	22	2	7	5	0	0
Kazakhstan	84	171	23	2	0	0	0	0	0	0	0	0
Lebanon	0	0	0	6	75	37	0	24	44	54	34	6
Libya	0	89	14	9	0	1	20	0	20	31	58	38
Sri Lanka	0	0	16	77	51	4	0	1	20	39	69	3
Latvia	171	76	1	0	0	32	0	0	0	0	0	0
Maldives	212	68	0	0	0	0	0	0	0	0	0	0
Mexico	0	0	48	0	5	4	23	14	1	61	124	0
Republic of North Macedonia	3	125	37	0	19	62	0	7	17	4	3	3
Montenegro	48	43	114	0	0	0	0	0	0	0	0	0
Mongolia	225	50	0	0	0	5	0	0	0	0	0	0
Mauritius	180	98	0	0	0	2	0	0	0	0	0	0
Malaysia	6	136	96	23	3	6	9	1	0	0	0	0
Namibia	60	65	85	8	0	22	0	4	34	0	2	0
Panama	206	57	0	0	0	17	0	0	0	0	0	0
Peru	0	0	76	125	15	2	56	1	3	0	0	0
Poland	169	105	6	0	0	0	0	0	0	0	0	0
Paraguay	71	170	0	7	0	31	0	1	0	0	0	0
Romania	135	145	0	0	0	0	0	0	0	0	0	0
Russian Federation (the)	0	0	3	51	52	0	48	1	6	82	37	0
El Salvador	19	220	27	0	0	10	1	1	0	2	0	0
Serbia	0	0	103	15	0	4	53	0	0	0	0	0
Eswatini	64	157	3	0	0	12	21	4	19	0	0	0
Thailand	0	0	4	123	20	1	43	4	7	49	29	0
Turkmenistan	36	203	39	0	0	2	0	0	0	0	0	0
Tunisia	0	12	26	13	77	21	94	8	0	25	4	0
Turkey	0	0	0	0	27	8	68	15	14	91	57	0
Uruguay	267	13	0	0	0	0	0	0	0	0	0	0
South Africa	0	80	152	25	1	0	22	6	0	0	0	0

The interaction between development and conflict is immediately evident in these two tables. In general, countries falling into the bottom 37.5% according to GDP per capita are spending significantly longer periods of time in the *High risk* (stages 5 to 10) or *High violence* (stages 11 and 12) group compared to those in 37.5% to 75% percentile.

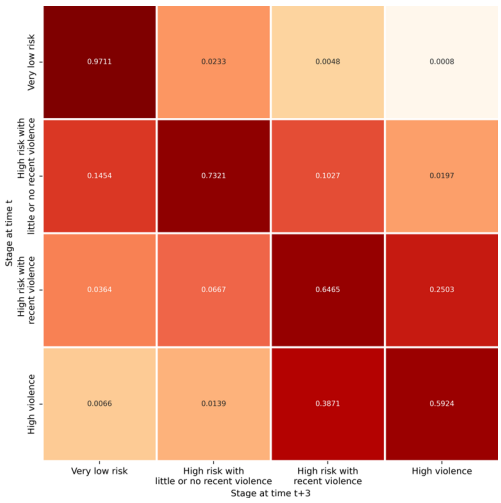
The key ingredient of our Markov model is the dynamic link of the stages through a Markov transition matrix. Conflict dynamics are modelled by observing how often each stage follows another (using the stage transitions for all countries for the period January 2000 to April 2023) and recording the probabilities in a transition matrix. The transitions between the 12 stages used in the model is represented visually in Figure 4a. The column indicates a country's current stage and the row indicates the country's most likely stages in three months time. A deeper shade of red indicates a higher probability. Each row sums to one.

Figure 4: Transition matrix between risk stages

a) 12-stage model



b) 4-group summary



In Figure 4b, the 12 stages are simply summarized into 4 groups according to the description provided above. This is possible through a simple addition of transition likelihoods and keeps in place the fundamental logic of dynamics shown in Figure 4a. We have also summarized the information in this table in Figure 1 in the introduction.

In what follows we will always define the conflict trap through conflict risk groups 3 and 4 in the 4-stage summary. This is justified by the strong interconnection between these two stages in Figure 4b and the fact that group 3 (stages 7 to 10 in the 12-stage model) mostly capture countries with recent conflict (see also Figure 1).

This dynamic view allows us to make three crucial observations:

1. **Stages are persistent:** As shown by the deep, dark red hue across the diagonal of the matrix, the most likely outcome is that a country remains in the same or similar stage. For example, the likelihood of starting in stage 1 and ending up in stage 1 is over 93%.

2. **Peace is stable:** As shown by the light orange area in the top right corner, it is rare for countries to start in stable peace and transition directly to conflict. Instead, countries usually pass from stable peace into a period of elevated risk, before experiencing intense violence. For example, for a country in stage 4, the likelihood of moving to any of stages 5-10 is 9%, whilst the likelihood of moving to any of stages 11-12 is only 0.2%.

3. **The conflict trap**: Similarly, countries rarely transition from intense conflict to stable peace—the light orange area in the bottom-left corner. In order to escape conflict, they generally experience extended periods of elevated risk before settling into a peaceful stage. This is the conflict trap.

Here, stages are merely summaries of the armed conflict data and risk forecast data, without any claim of causality. The visible dynamics between stages is driven by the forecasting system. Without a forecast, there would be no way to distinguish stages 1 to 6 with the observed conflict history. In this part of the stage space, stages are simple clusters of the risk data coming from machine learning. We will later assume that policy interventions can change these risks, i.e., for a given forecast, outcomes can be changed so that policies would lead to systematic forecasting errors.[1] This is exactly what Mueller and Rauh (2024) show in the case of interventions of power sharing agreements (in the month before adoption, power sharing leads to a systematic, substantial forecast error for 12-months-ahead forecasts; the forecast based on information available at T − 1 is thus too pessimistic for the period T to T + 11). Policies like power-sharing agreements can affect transition likelihoods causally.

Persistent stage dynamics are a key feature of the data. Sticky state dynamics and the existence of the conflict trap will drive gains of prevention in our analysis as keeping countries in low risk stages has significant dynamic benefits. We will return to this in Section 4 but we first provide an overview of the macroeconomic costs associated with conflict and the conflict trap.

3.2 The macroeconomic costs of conflict

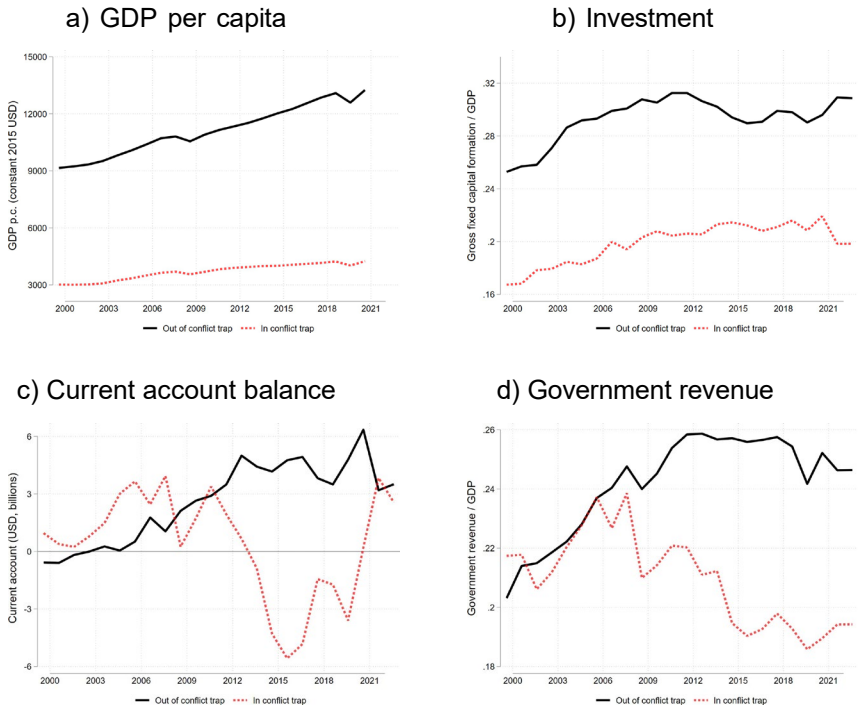
Countries with higher GDP per capita tend to face less conflict risk. For instance, the Pearson correlation coefficient between GDP per capita and the 12 risk stages is -0.40. Figure 5 provides simple summary statistics of important macroeconomic indicators for countries in the conflict trap—defined by stages 3 and 4 in the 4-stage summary. Countries in the conflict trap (about 35 countries over the period 2000-

[1] Policies leads to unfilled expectations - an inverse Lucas critique.

2023) grow more slowly, have lower investment rates, have more volatile current accounts, and lower government revenues compared to the 130 countries that have avoided the conflict trap. GDP per capita in the countries that have avoided the conflict trap has risen, on average, from around US$9,000 to US$13,000 in the last two decades (Figure 5a), a much larger increase than what has been seen in countries in the conflict trap.

Two additional stylized facts support the theory linking the poverty trap and the conflict trap (see also additional stylized facts in Chami et al. 2021a). The first one is that investment is much lower in countries in the conflict trap. Despite a lower GDP, countries in the conflict trap have a ratio of gross fixed capital formation to GDP of only about 20%, versus 30% in countries that have avoided the conflict trap (Figure 5b). Low investment is likely a driver of the disappointing growth observed in countries in the conflict trap. A second visible correlate of the conflict trap is low government revenues. Government revenues are below 20% of GDP, on average, in conflict trap countries but it has reached close to 25% of GDP in countries that have avoided the conflict trap (Figure 5d). Since revenues are an important driver of state capacity, this finding supports the view that weak state capacity is a factor in the conflict trap (Besley and Persson 2011a).

Figure 5: Macroeconomic indicators over time



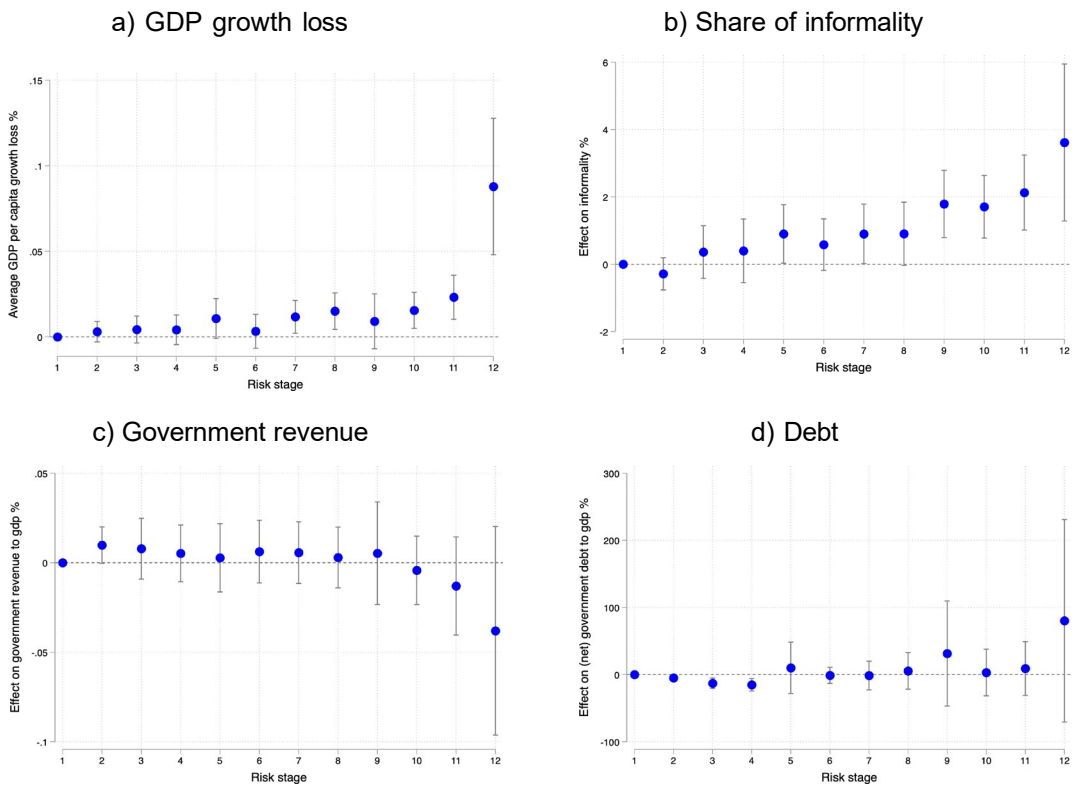
Groups are constructed according to which conflict stage countries started most semesters over 2000-2023. Countries in the conflict trap started most semesters in stages 7-12 (groups 3 and 4 in the 4-stage version), whereas countries out of the conflict trap started most semesters in stages 1-6. We fix the groups over time. Source: IMF (2022b).

Key to understand the cost and benefits from intervention is a rough quantification of the damages from conflict. The macroeconomic costs of conflict are assessed here using simple OLS regressions, associating the risk stages with measurable outcomes. Figure 6 shows the relationship between the risk stages and GDP per capita growth, government revenue, debt levels, and the share of informality in the labor market.[23] These show parameter estimates from model (2):

$$y_{i,t} = \alpha_i + \lambda_t + \sum_{s=2}^{12} \rho_s d_{i,t}^s + \varepsilon_{i,t}, \qquad (2)$$

where $y_{i,t}$ is an outcome variable for country i in year t, α_i is a country level fixed effect, λ_t is a year fixed effect, $d^s_{i,t}$ is a dummy variable equal to 1 if country i was in risk stage s at time t and $\varepsilon_{i,t}$ is an error term, which is assumed to be independent across (but not within) countries.[2]

Figure 6: Relationship between risk stages and macroeconomic conditions



Notes: The coefficients and their 95% confidence intervals are derived from two-way fixed effect regressions. The data sources for the outcomes are the IMF World Economic Outlook and World Bank.

[23] We also cover other aspects of fragility such as trade disruptions and financial stability which are not shown here as results are less clear cut.

[2] This is the best possible identification strategy we are aware of and follows Cerra and Saxena (2008) and Mueller (2013). For a discussion of reverse causality and omitted variable bias, both valid concerns in the use of this method, see Mueller et al (2017).

In general, a higher stage is associated with worse outcomes. For example, a country spending 1 year in any of stages 1-4 would not experience GDP losses in excess of 1% on average. But for stages 11 and 12, countries would expect GDP to contract by 2.7% and 9.2% respectively. This analysis, however, follows a simple static view in a dynamic world - optimizing policy in this view is analogous to playing chess without thinking ahead. The next section explains how to integrate dynamics thanks to the 'Dynamic Early-Warning Action Model.'

4. The Dynamic Gains of Conflict Prevention

Early-warning systems can be extremely valuable for identifying countries that are not currently in conflict but are susceptible to an outbreak in the short to medium term. However, there exists little guidance on how to integrate these systems for the purposes of policy evaluation. Here we present a brief overview over the 'Dynamic Early-Warning Action Model' (DEWAM) presented in more detail in Mueller et al. (2024a).

The value of prevention seems obvious and extends far beyond purely economic interests: by anticipating events we can act before crises break out to minimize the tragic impacts of humanitarian disasters. Yet, there exists a critical trade-off that is frequently misunderstood. Prevention necessarily requires acting in uncertain situations identified with imprecise forecasts, rather than reacting to the materialization of conflict. In other words, maximizing the potential benefits of early-warning systems requires accepting false warnings, also called false positives. Although this is a well-understood consequence of a prevention approach to policymaking,[11] it implies that, inevitably, prevention will also allocate resources on addressing crises that may never happen. This is because not all policies that are good for economic development and growth are automatically stabilizing.[3] Therefore, policymakers require a tool that integrates actual forecasts to evaluate the trade-off between the benefits of preventative action and the costs of acting on false positives.

The proposal made here is to use the Dynamic Early-Warning Action Model to assess the returns to prevention and the effects of macroeconomic policies on conflict risk. DEWAM represents a significant advance on earlier models by integrating the monthly forecasts provided by the machine learning model ConflictForecast into a dynamic optimal policy simulation with a nuanced model of the conflict trap. Importantly, ConflictForecast 's combination of monthly data with machine learning leads to a much more nuanced view on pre-conflict risks. The approach is used to estimate the returns to prevention. In earlier analyses, based on Mueller (2017) and Mueller and Rauh (2018), World Bank (2018) found that that $1 of preventative activities generates on average $16 worth of gains in the future. This paper updates these calculations by taking into account the dynamic implications of the conflict trap as Mueller et al. (2024a) find that this leads to dramatically higher prevention gains. An additional advantage of the DEWAM is that

[11] In order to prepare its staff for early action, UNICEF, for example, calls for a no-regrets attitude (United Nations 2024).

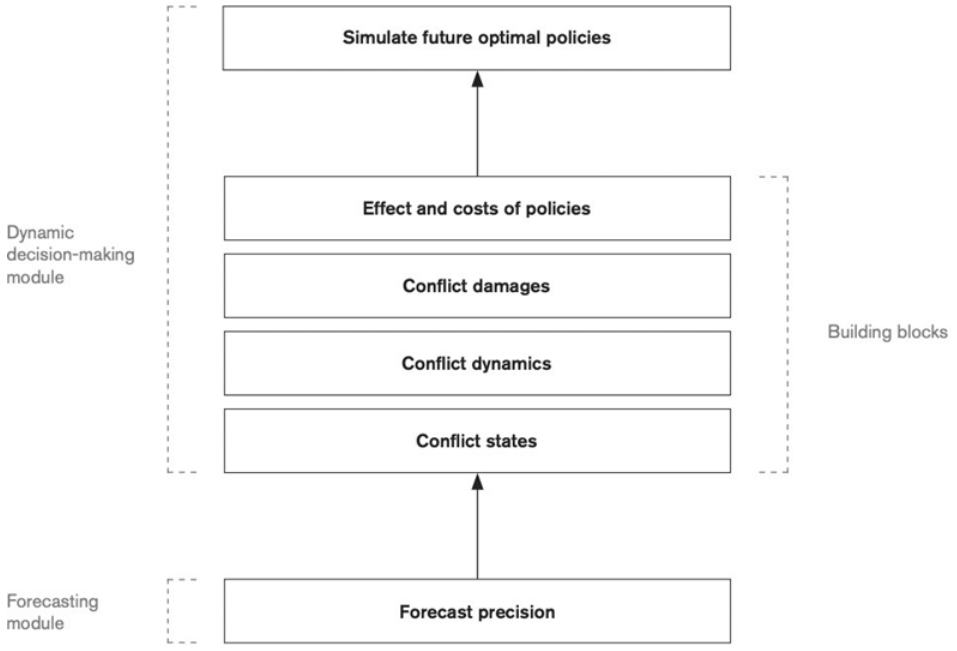
[3] See Rohner (2024) for an overview of some of the academic debate and Sonno (2024) for a discussion of the negative repercussions of foreign direct investment, for example.

it utilizes Dynamic Programming to account for future optimal policy reactions to changing conflict dynamics.

Figure 7 shows the structure of the DEWAM. The ConflictForecast's forecasting module at the bottom of the figure is based on a machine learning model that leverages close to 6 million news articles to forecast armed conflict outbreaks and the intensity of violence twice per month. The dynamic decision-making module is set-up through a linear programming problem. In the model, a policymaker faces a known transition matrix (as shown earlier), damages associated with each conflict risk stage and intervention costs and must decide her policy response repeatedly. Interventions are possible at any time with governments immediately incurring the associated cost, but only affect outcomes by shifting probability masses in the Markov chain shown in Figure 4.

The resulting framework allows us to simulate the trade-off between acting on weak signals early, at a relatively low intervention cost, versus responding to crises once they've broken out and incurring both the increased intervention costs and damages associated with the conflict trap. This is, at its essence, a trade-off determined by the properties of the forecasting system and the nature of conflict dynamics and damages. It therefore requires a unified system in which forecasts are integrated with estimates of conflict damages and conflict dynamics. The element allowing for this integration is the conflict risk stage model presented in Section 3.

Figure 7: The Dynamic Early-Warning Action Model (DEWAM)



To conclude the dynamic programming problem for the optimal decision module we need a damage vector, an intervention cost vector and a model of how the intervention changes outcomes (see some robustness

checks in Appendix B). We can then use this information together with the transition matrices shown in the main text to optimize.

Damage vector. Section 3 presented some measures of the costs of conflict. For our simulation of damages we use the outcome of the regressions of GDP loss in Figure 6 together with data on fatalities, ODA flows (categories capturing rebuilding and humanitarian aid) and refugee flows to quantify the full costs of conflict.[27] ODA is categorized as spend only relating to emergency response and peace/security. Despite its obvious limitations, we assign monetary values to the cost of life and displacement. Using Leon and Miguel (2017) we assume an average Value of Statistical Life (VSL) of $900,000. Refugee per capita costs are crudely assumed to be $100 - the total UNHCR budget in 2021 divided by the total number of refugees.

Cost of intervention. Before we discuss our assumptions, it is worth stressing that the motivation for our simulations is not to derive the true value of specific interventions but to illustrate what interventions benefits arise from a dynamic framework when initiated with reasonable assumptions on intervention costs. In addition, we highlight that associating interventions with a financial cost in each stage is challenging given the lack of available data on the monetary cost of different policies. Given this, cost estimates were calibrated, through close collaboration with policymakers (Mueller et al. 2022), under two different types of costs:

- **Fixed cost of intervention:** Countries are assumed to be investing in policies to mitigate conflict, irrespective of what stage they are in. The cost is proportional to the size of the population, at $3 per person per year ($0.25 per person per month).

- **Variable cost of intervention:** Costs are assumed to rise in line with the expected number of fatalities in each stage.[25] In other words, the more deaths resulting from a hypothetical conflict, the higher the intervention cost. Therefore, given the characteristics of our stages, interventions become extremely costly in stages 11 and 12. There is little distinction in the costs of intervening across stages 5 to 10 as these are typically non-violent.

For context, policies in stage 4 might relate to institution building at a cost of $164mn every quarter for a country with the population size of Pakistan. Stage 12 interventions would cost $9.45bn every quarter and would imply the mediation for a ceasefire, a massive deployment of peacekeeping troops and/or Disarmament, Demobilization and Reintegration (DDR) initiatives.[26]

How intervention affects outcomes. A range of policies, such as building state capacity or peacekeeping interventions, can reduce conflict risk. Macroeconomic policies can also reduce violence; indeed, the next section presents evidence that improvements in the fiscal balance can reduce violence by 7-10 percent. The DEWAM model does not require specifying the form of the policy, and for now, the presentation can remain abstract, assuming that a policy is able to *decrease the likelihood of moving to a higher stage* and to *increase the likelihood of moving to a lower stage* (see Figure 18 in Annex B). The change in probabilities shown

[25] This requires making an assumption of how much costs rise for each additional fatality. As part of the simulations, three values are tested: $10,000 per fatality and $40,000 per fatality and $200,000 per fatality.

[26] Stated costs for Pakistan assume a variable cost assumption of $200,000 per fatality.

assumes policy effectiveness of 10%.[4] In other words, a policy intervention decreases the possibility of transitioning into conflict and increases the possibility of moving toward peace.

We present the results for a sample of countries in the bottom 75% ranked by GDP per capita. Calculations are undertaken for a range of assumptions on the cost and effectiveness of policies (Appendix B.2). Under a *neutral* scenario regarding assumptions on the effectiveness of prevention, rates of return range from $26 to $75 per $1 spent on prevention for countries that have not recently suffered from violence. For countries at *High risk* that have suffered from violence recently, rates could be as high as $103 per $1 spent on prevention. Table 3 presents benefit-cost ratios (BCR's) of prevention policies for each of the four groups, and Appendix B.2 presents some additional details and robustness checks.

Table 3: Average returns to $1 invested in policy interventions

	High risk		
Very low risk	**With litte or no recent violence**	**With recent violence**	**High violence**
26	75	103	27

These findings are higher than those previously estimated in the literature (World Bank 2018). This reflects a recognition within the framework that periods of *High violence* are persistent, associated with substantial economic damages and require interventions that are significantly more costly relative to policies enacted when countries are at *High risk*. Importantly, we assume that policy instruments can be targeted using monthly forecasts and initiated within a quarter. Our simulations therefore support the case for a truly preventative approach to policies that address fragility in circumstances with no open or recent violence. In the simulations just presented, as discussed, policies take an abstract form and have an assumed uniform effectiveness rate. To understand how macroeconomic policies can play a role for conflict prevention, in the following sections we investigate whether policies and engagement by international actors have an effect on conflict risk.

5. The Role of Macroeconomic Policies and International Support

In this section we elaborate on how sound macroeconomic policies, combined with international support, can mitigate the risks of conflict, emphasizing the importance of fiscal capacity, government effectiveness, and the impact of external interventions.

[4] Estimates in Mueller and Rauh (2024) suggest violence reduction of close to 50% with interventions are possible, so our calibration here is conservative.

5.1 The economic drivers of conflict

A large literature in economics has helped our understanding of the consequences of exogenous macroeconomic shocks for conflict. Although, in general, macroeconomic instability is expected to increase the risk of conflict, the findings of the literature on the effect of income shocks have been less consistent than one would assume.

Rainfall shocks have, for example, been used to identify the effect of economic activity on conflict but the mechanism seems to be mediated by other factors (Sarsons 2015, Berman and Couttenier 2015). This controversy has also reached into the climate and conflict literature where different research teams find different results.[12] Other research shows that economic declines in trading partners increase violence (Dell et al. 2019), but there is also some controversy regarding the role of commodity prices (Bru¨ckner and Ciccone 2010, Bazzi and Blattman 2014, Berman et al. 2017). This is most likely because institutions and other factors mediate the effect of shocks (Fetzer and Kyburz 2022) and because distributional considerations are important to understand how income shocks affect politics (Dube and Vargas 2013, Ray and Esteban 2017). External financial flows may also affect fragility. Sonno (2024) uses a geo-referenced dataset of multinational enterprise engagement and conflict data in Africa and finds that multinational investments, particularly in land-intensive sectors, increase the number of violent conflicts. The negative impact of multinationals is particularly pronounced in areas with large-scale land acquisitions, possibly because multinationals control of resources such as land exacerbates local grievances, given the significance of farming for food and income.

There is much less literature on the effect of economic policies on conflict. A macroeconomic perspective is given by Akanbi et al. (2021), who find that avoiding economic contraction is critical to prevent a country on the brink of fragility from falling into crisis, implying that counter-cyclical macroeconomic policies are likely to reduce the risk of conflict. The most direct evidence of the role of economic drivers of conflict however comes from microeconomics studies, especially of the effect of employment programs on violence. The provision of employment opportunities directly demobilizes fighters and provides a cushion for economic shocks (Blattman and Annan 2016, Fetzer 2020). Inequality also plays a role. However, again the mechanisms are not straightforward. There seems to be a strong positive association between inequality within ethnic groups and fragility (Huber and Mayoral 2019). This implies that macro policies that generate employment opportunities will tend to reduce fragility.

5.2 Identifying the effects of macroeconomic policy shocks

Assessing the effect of macroeconomic policies on the likelihood of conflict requires addressing the issue of endogeneity of policies. To make some progress on this we apply the matched difference-in-difference methodology from Mueller and Rauh (2024) to examine the causal connection between government balance/public expenditure shocks and conflict, measured either in terms of incidence of violence (months with violence) or in terms of intensity of violence (log number of fatalities). In addition, to remove

[12] Contrast, for example the overview article by Burke et al. (2015) with the expert survey by Mach et al. (2019).

changes in macroeconomic policies that are expected given the economic developments, we construct policy shocks based on forecast errors, in the spirit of Auerbach and Gorodnichenko (2013). The method relies on subtracting realized data from previous projections as reported in the IMF World Economic Outlook (WEO). We use two macroeconomic measures of fiscal policy (government balances and public expenditure, both expressed in percent of GDP)–this paper focuses on fiscal policy because fiscal capacity is critical to the issue of state fragility, but other macroeconomic policies could be the subject of future research. The WEO forecasts are published in April and October of every year from 1990 to 2022. Therefore, estimates of policy changes and shocks to the economy can be constructed at the semi-annual frequency, for two semesters covering the periods running from April to October and from October to April. For the government balance, public expenditure and unemployment rate, the forecast error is defined as the difference between the current WEO edition forecast and the previous edition's forecast.[13] Shocks are then defined as binary variables, at the semi-annual frequency, if the forecast error exceeds a given cutoff, as reported in Table 4.

The treatment group consists of countries that received a policy shock and the control group consists of countries that did not. If treated and control group are diverging after the treatment but comparable otherwise, then we can attribute changes in the outcome variable to treatment. This requires that the control and treatment group have comparable profiles of conflict evolution prior to the policy shock. However, as Figure 8 shows, countries in advanced stages of conflict risk are also countries where fiscal consolidation polices tend to be implemented.[14] Hence selecting the appropriate control group is critical to identification. In particular, it would not be appropriate to compare a country in stage 11 subject to a policy shock to a country in stage 1 not subject to the same shock. If the "treatment" country's conflict risk escalated following the implementation of the policy and the "control" country did not, we would be unable to conclude that this was due to the shock as countries in stage 11 are more likely to escalate at any given moment, whether they receive a policy shock or not.

Table 4: Percentile cutoffs for each macroeconomic shock

Shock	Cutoff value	Cutoff percentile
Change in public expenditure (percent of GDP)	≤ −1.1	10
Government balance (percent of GDP)	≥ 1.5	90
Unemployment rate	≤ −.81	10

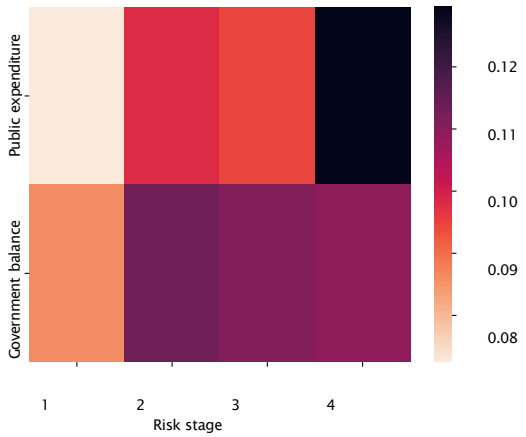
Note: Cutoff values are in percent. For public expenditure we define shocks as reductions in expectations from one update to the next in the lowest 10 percent of the distribution, below 1.1 percent contraction of public consumption expenditure. Government balance shocks are defined as increases in expectations above 1.5 percentage points. Unemployment rate decreases of more than 0.8 percentage points are treated as shocks.

[13] We normalize by GDP to make deviations from expectations comparable across countries of varying size. To maximize data coverage, we use realized GDP and not potential GDP, which is less subject to fluctuations.

[14] Note that while fiscal adjustment happens in all countries, the binary shock indicator considers only large ad- justments compared to the entire distribution for all countries, and such large adjustments appear more frequently in countries at higher risk of conflict.

Hence, we construct a control group by selecting countries with a similar distribution of conflict risk prior to the policy implementation. Countries are matched based on their predicted intensity of conflict so that the control group looks as similar as possible to the treatment group in terms of their projected trajectory in terms of violence.

Figure 8: Risk profile of fiscal policy shocks



Notes: Distribution of positive government balance and negative public expenditure shocks by risk stage. Data on government balance and public expenditure are from the IMF World Economic Outlook.

Once we have constructed the control group following Mueller and Rauh (2024), our estimation of the difference-in-difference model follows Callaway and Sant'Anna (2021).[15] For this we generate treatment windows for both treated and matched control group which we match on the risk before a placebo treatment period.[16] The estimation equation for these models is:

$$y_{i,t} = \gamma_{g(i)} + \lambda_t + \sum_{j=-3}^{4} \rho_j I_j + \epsilon_{i,t} \qquad (1)$$

where $y_{i,t}$ is the share of months with any violence or the log number of fatalities in a semester in country i at period t within a [−4, 4] semester window around treatment, γg(i) is a fixed effect which captures the period-invariant difference in the outcome variable between the control and treatment groups, λ_t is a trend which captures the common evolution in violence and fatalities across groups within the period, and I_j is a dummy variable equal to 1 for countries in the treatment group at j periods to treatment and 0 otherwise, $\varepsilon_{i,t}$ is a classical error term.[17]

The coefficients ρ_j thus capture the difference-in-difference in the conflict-related outcome variable between treatment and control groups relative to a base period prior to treatment. To infer a causal effect of the policy

[15] We use the STATA csdid package.

[16] Again, see Mueller and Rauh (2024). A short summary and presentation of the causal inference strategy can be seen following this link https://www.economic-policy.org/77th-economic-policy-panel/power-sharing/.

[17] Any violence is defined as at least one UCDP GED fatality in a given month. For the log of the number of fatalities, we add +1 so that the log is defined.

shock we would thus want to see that the ρ coefficients are close to zero up to $j = 0$, when treatment occurs, and become positive or negative thereafter.

5.3 Results

Figure 9 shows that on average, positive shocks to the overall fiscal balance seem to decrease the incidence of violence (LHS chart) but, more significantly, reduce its severity (RHS chart). The pre-treatment estimates are not significantly different from 0, providing reassurance on the use of the matched difference-in-difference approach. The post-treatment estimates imply that a substantial improvement in the fiscal balance relative to the forecast (in the top 10 percentile, or at an improvement by 1.5% of GDP of the fiscal balance) leads to a reduction in conflict deaths by 9%.[18]

How do these numbers relate to the simulations in section 4 and the benefit-cost ratios shown in Table 3? The policy effectiveness calibration we assume in our simulations implies a reduction in violence by between 7 and 10%, i.e., in line with the reduction in violence shown in Figure 9.[19] This is important because it shows that there are macroeconomic policies which are able to shift violence levels by a magnitude consistent with our simulations.

The *intervention costs* of improving the government balance by 1.5% of GDP, with official grants, would be around US$100 per capita for a country like Libya (among the highest- income fragile states) and around US$10 per capita for a country like Chad (among the lowest- income fragile states). To put this number into perspective, Chad has received on average grants worth US$22–28 per capita (about US$350 million) for economic and other development go. Our assumption of intervention costs for violence reduction (US$3 per capita, under the assumption of fixed costs of intervention presented in Annex B.2) is far below this. But this comparison assumes that the intervention of improving the government balance by 1.5% of GDP, through official grants, has no other benefit than reducing violence, which is obviously not true as such grants also beneficial for other economic and development purposes.

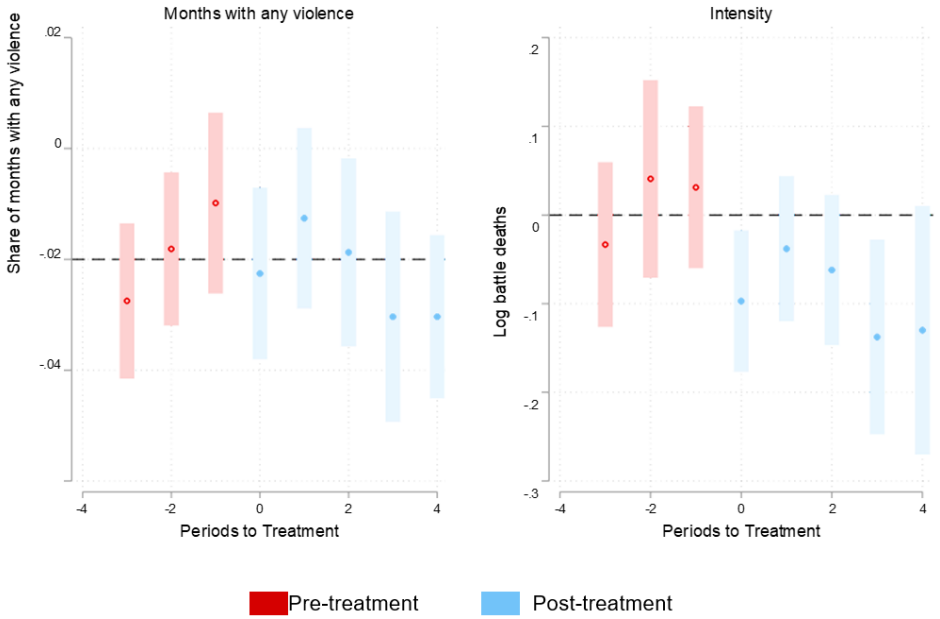
There is another way to see these results. The benefit-cost ratios we calculate are coming from an infinite horizon model in which a costly action is taken today and has discounted future benefits coming from the changing violence dynamics in the future. Our calculations in Table 3 show that such an intervention in preventative stages is justified even if it were to cost over US$200 per capita per year.[20] What Figure 9 shows in this context is that it could be possible to achieve violence reductions like this through substantial macroeconomic policy shifts.

[18] When we report the average effect, we are reporting the average treatment effect on the treated (ATT).

[19] To check this, we simulated a country starting in conflict risk stage s with and without a policy in place and compared simulated violence levels. It is obtained with a policy effectiveness parameter of 10% as presented in the model of Mueller et al. (2024a).

[20] The future discounted benefits are more than 70 times higher the assumed costs of US$3 per capita.

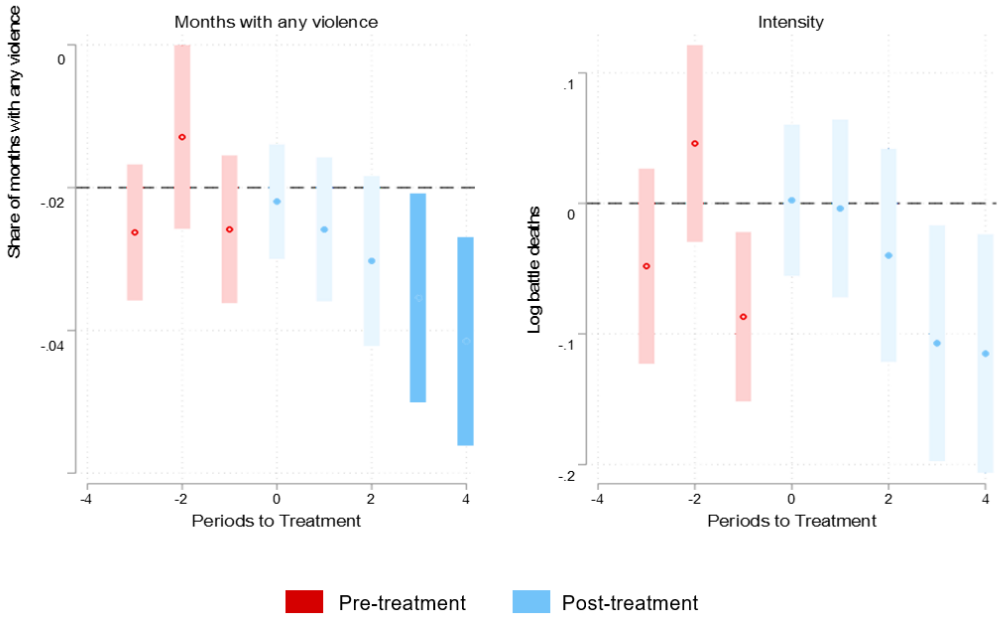
Figure 9: Impact of positive shock to fiscal balance on the occurrence and intensity of violence



Notes: Difference-in-difference analysis from Equation (1) with positive shocks to the fiscal balance as the treatment variable and the share of months spent in violence at the semester level and log-fatalities as the outcome variables. The overall fiscal balance data is obtained from IMF World Economic Outlook database and the violence data from UCDP.

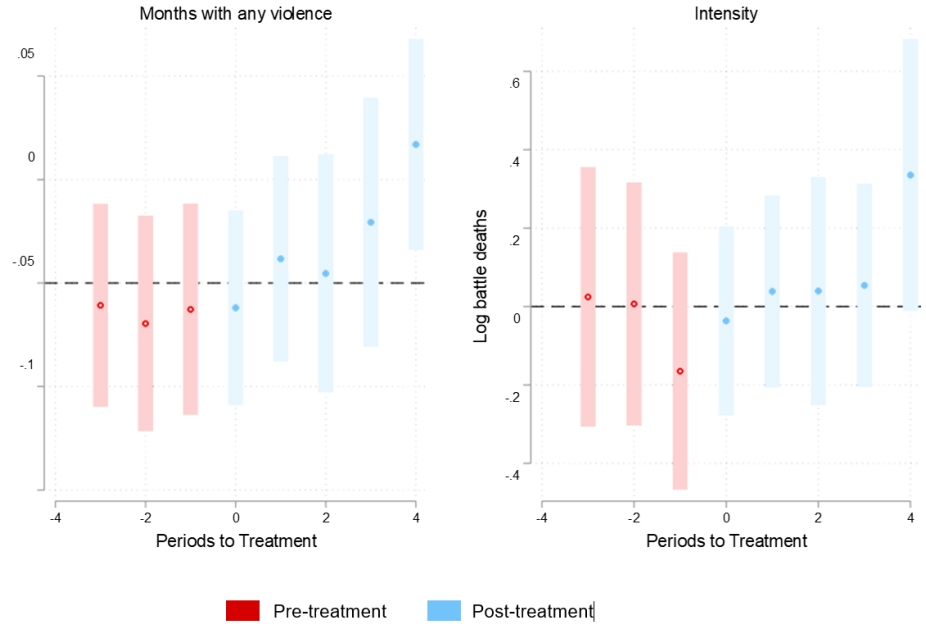
However, identification issues here loom large and so it is worth exploring the potential channels of this result. There may be several reasons why stronger fiscal balances reduce the risk of conflict, in a causal sense. First, a stronger fiscal position provides space for a government to react to negative shocks, preventing economic contractions, which Akanbi et al. (2021) have found is critical to prevent a fall into fragility. We indeed also find that large shocks to unemployment might affect the intensity and severity of violence (Figure 10), though parallel pre-trends do not hold for conflict intensity. On average, the likelihood of violence falls by 1.1 percentage points following a drop in the unemployment rate relative to the forecast (in the bottom 10th percentile, i.e. a fall by about 0.81 percentage points), whilst the severity of violence (conflict deaths) falls by 5.2%. From a policy perspective, this lends support to the results of Fetzer (2020), who finds that 100 day guarantees of employment by the state led to persistently lower conflict levels in India. Similarly, Blattman and Annan (2016) argue that material economic incentives systematically affect motivations to engage in violence. Their study focuses on ex-fighters in Liberia, indicating that employment policies can be well-suited for countries emerging out of recent violence. Second, strong fiscal capacity and thus strong state capacity also has a deterrent effect on challenges to the ruling government. Especially in places characterized by a fractious political context, a state with a stronger fiscal position will be in a better position to defend itself from potential challengers thus discouraging attempts to subvert the ruling government and existing institutions. Nevertheless, whilst strengthening defense and security can be an important aspect of violence-reduction, there is a range of evidence to suggest that complementing effective security provision with policies to increase public service provision is the most effective way to reduce violence (Berman, Shapiro and Felter 2011; Berman et al. 2013; Sánchez de la Sierra 2020).

Figure 10: Impact of drop in the unemployment rate on the occurrence and intensity of violence



Notes: Difference-in-difference analysis from Equation (1) with unemployment rate as the treatment variable and the share of months spent in violence at the semester level and log-fatalities as the outcome variables. Unemployment rate data is obtained from IMF World Economic Outlook database and violence data from UCDP.

Figure 11: Impact of negative public expenditure shocks on violence occurrence and intensity



Notes: Difference-in-difference analysis from Equation (1) with public expenditure shocks as the treatment variable and the share of months spent in violence at the semester level and log-fatalities as the outcome variables. Public expenditure data is obtained from IMF World Economic Outlook database and violence data from UCDP.

However, how improvements in the fiscal position are achieved appears to matter greatly. Indeed, Figure 11 shows that sharp public expenditure cuts relative to the forecast (in the lowest 10th percentile, or cuts of at least 1.1% of GDP) worsen the incidence and severity of conflict. Public expenditure cuts of this magnitude appear to increase the share of months in conflict by 2 percentage points and the number of fatalities by 8.5%. This result confirms the importance of maintaining essential government functions as well as pre-existing social contracts.

This analysis thus offers cautious support for the point of view of Besley and Persson (2011a) that fiscal consolidation and increasing state capacity through higher government revenues reduces the intensity and incidence of conflicts. Improving the fiscal balance can be beneficial to strengthen state capacity, but if it is achieved at the cost of the delivery of public expenditure or at substantial changes in the social compact, it will not lead to conflict de-escalation. It is critical to stress that these results, by design, only hold on average and will not be true in all cases. Conflict de-escalation and prevention are complex policy goals that require attention to several social and political dimensions that go beyond macroeconomic vulnerability and state capacity. Nonetheless, assuming these have been adequately considered, states with higher capacity and a stronger fiscal position will be in a better position to implement most policies, including conflict de-escalating measures.

It is also important to note the implication of our results that macroeconomic stability and reduction of fragility can go hand-in-hand. Not only can revenue mobilization—an economic priority for the development partners of fragile states— reduce the risk of conflict by raising fiscal capacity and protecting expenditure, policies can also be designed with both objectives in hand. Noteworthy are policies that increase accountability, as they can both save resources—and thus improve macroeconomic stability—and strengthen the social compact—and thus reduce the risk of conflict. The literature has thus emphasized the importance of policies working for the common good and of transparency and checks and balances in government (LSE-Oxford Commission 2018; Akanbi et al 2021). A concrete, striking example, is the landmark program initiated by the Controladoria-Geral da Uniao (CGU) in Brazil which randomly assigned municipalities to be audited. A recent review by J-Pal shows that such audits tend to be an effective policy to increase political accountability, reduce misuse of public resources, and improve compliance with laws and regulations.[21] Tax audits can also increase revenues and have dynamic effects by shifting norms in weakly institutionalized environments (Weigel 2020).

Our results also underscore the importance of the health of the labor market, as reflecting well the economic situation of populations (even though the unemployment rate may itself be an imperfect measure of the health of the labor market). The conflict literature has documented that commodity windfalls that do not lead to large employment gains can trigger violence instead of preventing it (Dube and Vargas 2013). Mining activity, which can raise GDP substantially but with very uneven distribution of profits, is actually a common trigger for social unrest. Recent results in the literature confirm a strong link between mining activity, land-grabbing foreign investments and armed conflict (Berman et al. 2017,

[21] For an overview over this literature see J-Pal (2020). For a recent article on audits in Rwanda see Kotsogiannis et al. (2024).

Sonno 2024). This is important when designing economic policy in countries that are large producers of mining products, especially if the land used for mining is a key source of income to populations.

This brings us to a more general point. Escaping the conflict trap requires careful attention to both economic and political factors when designing macro policies (LSE-Oxford Commission on State Fragility, Growth and Development 2018). Our results show that the specifics of how improvements in fiscal positions are achieved matter. This is in line with research on the drivers of conflict which show that economic exclusion and norms of reciprocity which are maintained through the expenditure side matter critically for violence outcomes (Besley and Mueller 2021, Mueller and Rauh 2024). Our results on unemployment shocks square well with the results in the conflict literature that suggest that opportunity costs of conflict are an important driver of violence reductions and increases. But they could also stem from the feeling of economic exclusion, which is strongly associated with violence. This also highlights that attention needs to be paid to what policies are implemented with higher state capacity. The general conclusions from this literature are that state capacity is particularly useful for violence reduction when it advances economic inclusion and helps mitigate the effects of external shocks.

In light of the dynamic benefits of conflict prevention it is crucial to highlight that it is therefore good macroeconomic policy to design policies that pay attention to these mechanisms and thereby maintain peace. Economic gains cannot be maintained in the long run if they endanger a peaceful negotiated outcome between the state and the rest of the society (Fearon 1994, Cheng et al. 2018, Blattman 2022). Many of the policies recommended by Jaramillo et al. (2023) for climate adaptation in FCS countries, such as building fiscal buffers and strengthening institutional capacity to facilitate robust emergency responses, are clearly aligned with these goals. An interesting recommendation in this regard is the strengthening of social safety nets which is aligned with conflict prevention if done through employment programs. Transfer programs have been shown to have mixed effects (see Rohner 2024 for a review).

6. Engagement by the International Community

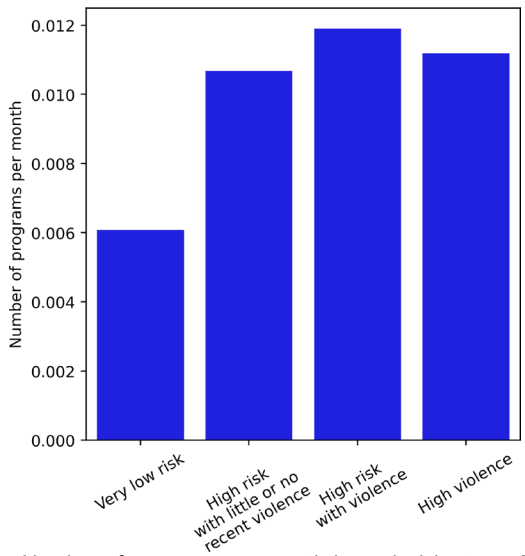
International organizations and donors have an important role to play in supporting sound economic policies in fragile states.[5] Official Development Assistance (ODA) to countries in situation of fragility and conflict was around US$130 billion in 2022 (OECD 2024). IMF-supported programs that provide frameworks for fiscal and monetary policies, deliver technical assistance, and catalyze ODA and other financing are key to the these efforts, delivering technical and financial resources for a gradual build-up of state capacity (IMF Independent Evaluation Office 2018; IMF 2022a). The literature has however noted the complexity of economic interventions in situations of conflict or fragility. Caselli and Presbitero (2021) provide a summary of the literature on the effectiveness of aid in fragile states and also find that projects implemented in a fragile state are about 8 percentage points less likely to be successful than similar projects financed in a non- fragile developing country. The returns to technical assistance may also be lower if governments are not ready to implement reforms (Chauvet and Collier 2004).

[5] We do not discuss the political economy behind coordinated policies in an environment of Geoeconomic fragmentation (Aiyar et al., eds (2023)) but multilateral institutions should play an important role in this environment.

This section considers the impact of IMF programs specifically, as a proxy for the broader engagement of the international community on economic stabilization. Although rates of successful IMF program completion are lower in fragile than in non-fragile settings, IMF programs strongly catalyze other donor's financing (Hitaj, Lane, Mehta and Turk 2021), and are thus good proxies for the engagement of the international community on economic stabilization. IMF programs have also been found to contribute to higher growth rates and to state building, with tax revenues increasing in fragile states after the start of programs (Collyns, Kuruc and Takagi 2021).

Our analysis uses the IMF Monitoring of Fund Arrangements (MONA) database, which covers the implementation of IMF arrangements since 1993. A binary indicator is constructed if any IMF program or program review was approved in a given month.[22] Figure 12 highlights that the IMF is already focusing resources on countries in the *High risk* group. Importantly, the IMF is even engaged in stages with little or no recent violence which can be interpreted as preventative situations (in terms of the risk of conflict). These are situations which we have identified as having the largest returns on prevention policies.

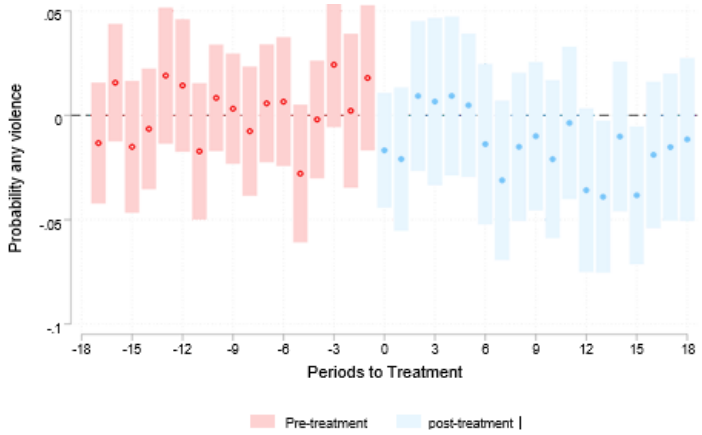
Figure 12: IMF program activity by stage



Notes: Number of programs per month in each risk stage. Data on policies are from the IMF MONA database.

[22] The variable is a binary variable that takes the value on the month the program of program review is approved at the IMF Executive Board, and zero otherwise, as reported in the IMF's MONA database.

Figure 13: Impact of IMF programs on violence



Notes: Difference-in-difference analysis from Equation (1) with IMF programs as the treatment variable and likelihood of having at least one battle-death (any violence) as the outcome variable. Data on policies are from the IMF MONA database and battle deaths from UCDP.

Are these IMF programs having a positive impact? To see this, we apply the matched difference-in-difference methodology as described above in equation (1) to the approval of programs and program reviews. Time periods are measured in months and the window around the introduction of a program or review includes the 18 months before and after IMF Board approval.

Figure 13 shows that, on average, program and program review approvals result in a slight reduction of the likelihood of a country experiencing any battle death in a given month by about 1.5 percentage points. Importantly, the effect seems to amplify after around a year to a reduction of around 4 percentage points. This suggests that the role IMF programs play in boosting growth, catalyzing donor support, raising revenues, and restoring confidence, is visible in lowering the risk of conflict. It does not, however, imply that it is only the IMF programs that contributed to this reduction in the risk of conflict. Our identification strategy does not account for possible ongoing and complementary policies of other multilateral development banks, development partners, and United Nations agencies. Furthermore, *The IMF Strategy for Fragile and Conflict-Affected States* recognizes that the Fund is one among the many organizations supporting countries affected by fragility and conflict. Nevertheless, our analysis highlights that IMF programs may entail a preventative role, and they can contribute to a reduction in conflict risk.

It is reassuring that IMF programs, which can upset political equilibria, do not increase the risk of violence on average. However, given the significance of international engagement on these issues, it is interesting to ask whether more could be done. The World Bank and the IMF developed specific strategies for FCS in 2020 and 2022 respectively with more resources devoted to countries included in their list of FCS—although, the FCS list is not designed to serve as a forecasting tool, and does not cover all the situations or countries with high risk of violence. Table 5 shows that, of the countries in the *High risk* groups, the large majority are not on the World Bank's FCS list—a list also used by the IMF. The table shows that countries in *High violence* stages have a likelihood of 86% to be on the FCS list whereas countries at

High risk only have a likelihood of 23% to be on the list. For prevention purposes, policymakers would benefit from a greater awareness of the potential for re-surging violence in the 77% of the cases that we categorize as *High risk* and that are not in the FCS list, even though our estimates show that this is the group where the largest intervention gains are to be made.

Table 5. Share of countries featured in the FCS list by group

Category	FCS	Non FCS
Very low risk	0.03	0.97
High risk with little or no recent violence	0.23	0.77
High risk with recent violence	0.23	0.77
High violence	0.86	0.14

Notes: The groups are calculated using data from 2022 and 2023 and then compared to the latest FCS list.

In other words, the IMF-supported programs are frequently underway in countries in *High risk* groups (Figure 12) but since these are not included in the institution's FCS list, it is unclear whether the economic programs and technical assistance are conducted with an eye on their repercussions on fragility. This suggests that gains beyond what is visible in Figure 13 could be possible. We conclude with policy recommendations addressed at the international community as well as at national governments in countries at risk of conflict.

7. Policy Recommendations

Acknowledging that the paper's findings do not distinguish between sources of conflict risk, which may come from different external or domestic factors, the research has important policy implications for the international community and for governments in countries at risk. For development partners and International Financial Institutions (IFIs), the recommendations are:

1. **Adopt systems to identify risks, such as early warning.** While countries with *High violence* make the headlines, there are currently 34 countries at *High risk*. Conflict prevention has high returns, but it has the highest returns in situations where outbreaks have not yet materialized. The focus should be on building systems to identify risks and possibly internal early warning systems to inform policy decisions in high-risk environments. This may require specific adaptions to internal processes to allow early warning systems to better guide policy adjustments and project design.

2. **Improve attention to prevention in policy design.** The IMF is relatively active in the kind of situations that our model identifies as ripe for high returns from a preventative approach. Presently, the IMF's FCS Strategy focuses primarily on countries that are already classified as fragile and conflict-affected. Given that there are many situations of high risks across all

economies (fragile or not), consideration should be given to internalizing the return to prevention policies in all situations of high risks.

3. **Resist the "blood leads" phenomena.** While man-made disasters require humanitarian support, our framework clearly shows that prevention is most effective in countries at risk that may not be on everybody's radar. Policy design needs to take the devastating effects of armed conflict into account. In countries with high risk, policies need to be systematically evaluated for their repercussions on fragility. For example, government expenditures are often part of stabilizing political bargains and expenditure reductions can negatively affect risks.

4. **Help build state capacity to strengthen the social contract.** Developing fiscal capacity increases resilience and thereby protects other economic and social development goals, such as inclusion (Besley and Mueller 2021). As discussed in Baer et al. (2021), program design needs to include specific institution-building goals, like modernization of revenue administrations, tax auditing systems, with a short-term objective to increase revenues and a medium-term objective to make tax collection more efficient, equitable, and transparent. These objectives are deeply political but can play a key role in the escape of the conflict trap if they do not increase exclusion. One way to achieve this is building institutions that help establish checks and balances and steer policy towards policy instruments that work for common purposes (LSE-Oxford Commission, 2018 and J-Pal, 2020).

For governments of countries in a situation of high risk of conflict:

1. **Recognize the tremendous economic costs of conflict.** The high economic toll of internal armed conflict should be understood and policy options designed accordingly. Conflict has unintended and cascading dynamics which can be impossible to predict or undo.

2. **Address exclusion.** When designing economic institutions and policies, actions should be taken to reduce economic and social exclusion, as these are major drivers of violence. Access to justice and to other public services directly reduces grievances. Economic exclusion plays an important role in fragility. Increasing employment opportunities directly reduces fragility.

3. **Support tax compliance.** Taxation increases expectations towards the state and these norms of reciprocity rely on citizens seeing that the state is using revenues for common purposes. To strengthen compliance, increases in taxation should go hand-in-hand with the effective and equitable provision of public services. A corrupt administration feeds into fragility by affecting social norms (Collier 2021). Independent watchdogs have been found to be an effective way to fight corruption.

4. **Build capacity.** Building state capacity has tremendous economic benefits because a more capable state can provide public services efficiently, address market failures, and promote the development of markets. But it also has large indirect economic effects through the violence

reductions it may be accompanied by if enhanced capacity is not used to accelerate economic or political exclusion. The magnitude of these indirect economic effects can be so large that it gives a completely new motivation for the development of state capacity in fragile contexts—purely on economic grounds.

These recommendations aim to promote peace, stability, and development in fragile situations through a macroeconomic lens. Low state and fiscal capacity are serious constraints and building capacity takes a generation. While the average long-term economic gains of capacity building are substantial, they require patience and persistence, and the acceptance that gains may not materialize in every case. International actors can provide support in the interim. Coordinated efforts by IFIs, national governments, and partner countries can help prevent the devastating impacts of internal conflicts.

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Appendix

A. Hidden Markov Model feature distributions

Figure 1: Distribution of best model outbreak forecast conditional on the stage

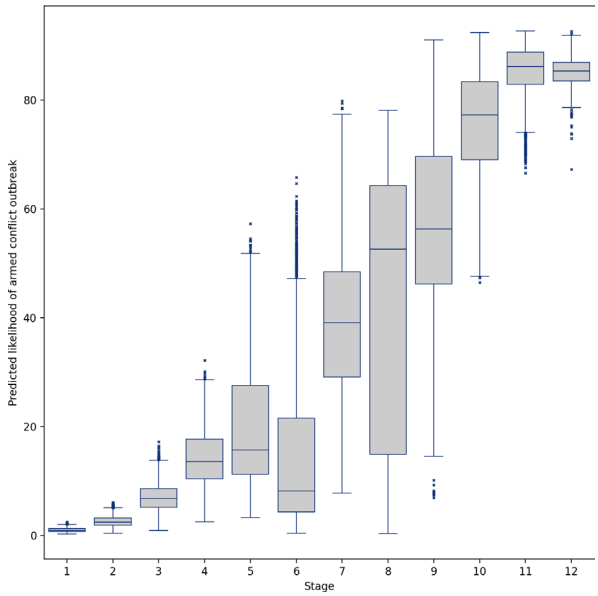


Figure 2: Distribution of text model outbreak forecast conditional on the stage

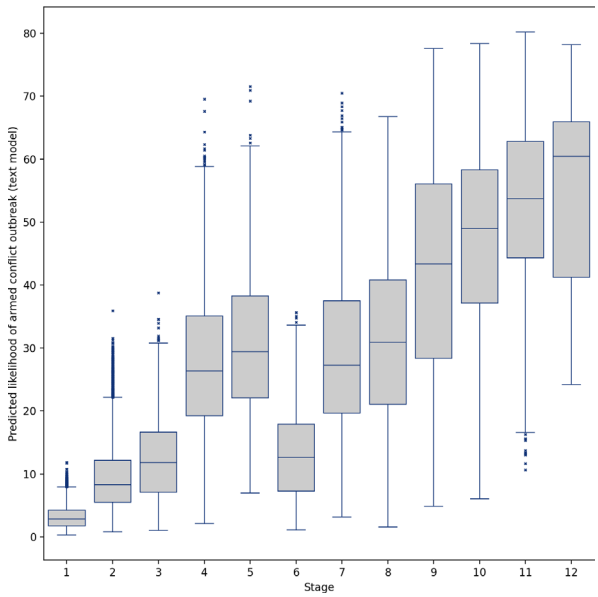


Figure 3: Distribution of intensity model forecast conditional on the stage

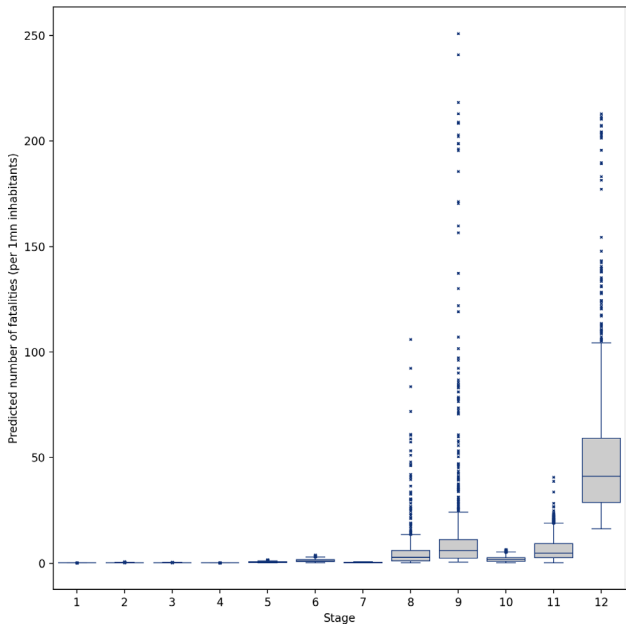
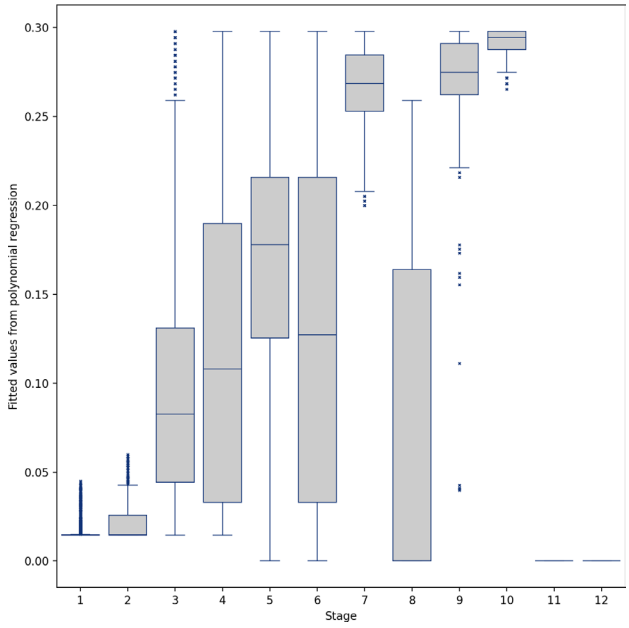


Figure 4: Distribution of fitted values from polynomial regression conditional on the stage



Notes: The fitted values are generated from a polynomial regression of the form $\hat{y} = \beta_0 + \beta_1 x + \beta_2 x^2 + \beta_3 x^3 + \varepsilon$ where x represents the number of months since the country last experienced armed conflict and the dependent variable is the onset of armed conflict in the next 12 months. Also note that where a country is deemed to be in armed conflict in that month, we manually set the fitted value to 0.

B. Dynamic Early Warning and Action Model

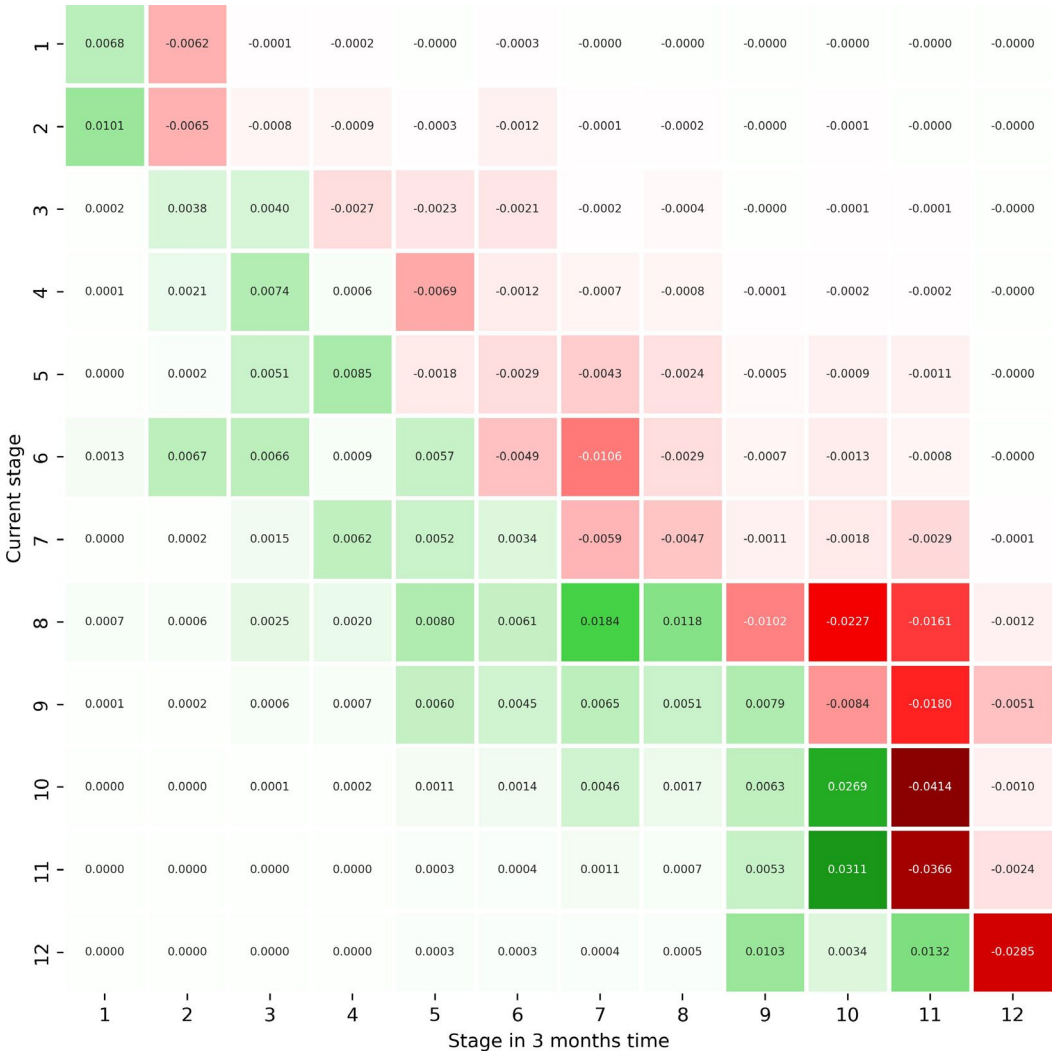
The DEWAM combines dynamics and outcomes. Compare two cases, a country in stage 3 and a country in stage 9. Where would we expect worse outcomes? It might seem obvious, but the static view tells us very little. In fact, average GDP losses from a year in stage 3 are -0.7% and -1.5% in stage 9. This is because neither stage 3 nor stage 9 are associated with high levels of current violence, hence we see small, statistically insignificant effects on the economy. Combining static losses with dynamics allows answering the question of which country one would expect to have worse outcomes in the future. From this perspective it is immediately obvious that stage 9is associated with more damaging outcomes than stage 3 - stage 9 is a situation of elevated risk which could very quickly escalate into violence, i.e. moving to stages 11 or 12. Even worse, moving to stages 11 or 12 can become persistent. This makes being in stage 9 even more perilous since it exposes the country to the possibility of suffering from the conflict trap and incurring losses for extended periods of time.

This notion of dynamic losses is a key way to communicate the purpose of the DEWAM and the integration of forecasts into decision-making. Acting now to prevent future damages requires understanding in what situations a country is exposed to possible future violence and its associated losses, even if today it appears that things are peaceful. *In expectation* a country is in a bad situation if it has a high risk of escalation.

B.1 Effect of policies

The simulations test a range of policy effectiveness levels (2, 5, and 10%). The more effective a policy, the more probability mass is moved. The probability of staying in the same stage does not change uniformly across the stages. In the case that the total likelihood of moving to higher stages exceeds the total likelihood of moving to lower stages, the probability of staying in the same stage increases. The vice versa is also true. Figure 18 shows the full changes in the transition probability under the assumption of policy effectiveness of 10%.

Figure 5: Changes in transition probabilities between stages under policy



B.2 Results

Bringing all these aspects together permits the simulation of policy interventions and evaluation of the prevention trade-off. The results are reported as a benefit-cost ratio (BCR), which can be interpreted as the dynamic long-run return per $1 spent.[28] A BCR less than 1 implies that the intervention is not cost-effective.

[28] The benefit-cost ratio is computed as gross gains divided by intervention costs. Future gains/losses are discounted using a rate of 4%.

The BCR takes into account the imprecision of risk forecasts and that policies are not guaranteed to be effective. For low stages where the forecast is relatively imprecise (i.e. more outbreaks are predicted than actually happen), large benefits of prevention need to compensate for low escalation risks to bring the BCR over 1.

This method not only takes into account imperfect forecasts but calculates the optimal decision in all possible future worlds. In the calculation of prevention, what a rational policymaker would do in a future in which the situation escalates is taken into account.[29] This might sound like a technical point but this ensures that the policy benefits are optimal, even under the assumption that the failure to prevent can be partially offset by later, optimal interventions.

As policies across the groups vary dramatically it is impossible to simulate specific policies. Model results are therefore presented across a range of scenarios that simulate policies under realistic assumptions to gauge the robustness of the simulated benefits. The pessimistic scenario assumes a world where the simulated policies are relatively ineffective, they only are successful in 2% of their applications, and intervening in periods of ongoing conflict is extremely costly (variable cost of $200,000 per fatality). By contrast, the optimistic scenario assumes that policies are relatively effective (10%) and that late interventions are more financially feasible (variable cost of $10,000 per fatality). Finally, in the neutral scenario policies are assumed to be effective in 5% of cases, and intervention costs increase by $40,000 per fatality in each stage. Lower costs of intervening in conflict-affected stages make prevention more attractive. The reported BCR's represent the average return across all countries that fall into the bottom 75% according to GDP per capita. There is also a differentiation between returns to interventions when including/excluding the effects of economic growth. This is because the economic benefits of preventing conflict are so large that policies always appear cost-effective.

[29] Dynamic programming is used to conduct simulations. This simulates an infinite number of future months and undertakes a full dynamic optimization with respect to policy.

Figure 6: Returns to interventions

(a) Including GDP growth effect

Stage	1	2	3	4	5	6	7	8	9	10	11	12
Optimistic	25.9	65.8	61.2	76.0	104.5	201.3	145.4	445.2	324.7	165.7	92.2	91.2
Neutral	14.1	35.8	33.3	41.3	56.7	108.5	77.8	200.9	168.8	84.1	29.6	14.7
Pessimistic	6.0	15.1	14.1	17.3	23.5	43.5	31.6	46.7	67.4	31.4	4.0	1.3

(b) Excluding GDP growth effect

Stage	1	2	3	4	5	6	7	8	9	10	11	12
Optimistic	0.3	1.0	1.1	1.5	2.6	4.4	4.0	14.3	12.5	6.4	4.4	6.5
Neutral	0.2	0.6	0.7	1.0	1.6	2.6	2.4	7.0	6.9	3.4	1.5	1.1
Pessimistic	0.1	0.3	0.3	0.4	0.7	1.1	1.0	1.6	2.8	1.3	0.2	0.1

The results show that, when including economic losses with respect to GDP, the economic and social policy benefits are greatest in situations of elevated risk (stages 5-10). According to this model, the optimal time for tailoring policy to fragility is in stage 8 or even 9. In the neutral scenario, returns to interventions are maximized in stage 8 with each $1 spent on prevention saving a monetary equivalent of $201 down the road in prevented economic losses, fatalities, displacement, and humanitarian aid. Despite not explicitly modelling the higher costs of post-conflict reconstruction efforts relative to pre-conflict prevention, the BCR figures in stages 5 and 6 are comparable to those of stages 7 to 10, particularly in the pessimistic scenario. This supports the case for a truly preventative approach to macro policies that address fragility in circumstances with no open or recent violence.

When excluding the effect of the risk stages on GDP growth, returns are markedly lower. In the pessimistic scenario, only stages 6, 8, 9 and 10 yield cost-effective interventions. Overall, the case for true prevention (i.e. policies in stages 5 and 6 where conflict has yet to break out) is generally weaker since this analysis ignores the substantial economic effect associated with high-intensity conflict. Nevertheless, it supports the case for post-conflict reconstruction efforts (interventions in stages 7-10) that help countries escape the conflict trap and avoid recurring loss of life, displacement and the need for emergency humanitarian assistance.

Note that in the main text we present results according to the four summarized groups: *Very low risk, High risk with little or no violence, High risk with recent violence, and High violence.* The results presented in the core of the paper a weighted average of the neutral scenario presented in Figure 19a, i.e. including the GDP loss. We include the GDP loss as this is relevant for a decision-maker that tries to evaluate the effectiveness of preventative macroeconomic policies. The BCR's are weighted according to the frequency of stages in a given group.

PUBLICATIONS