War and Entrepreneurship: A Synthetic Control Study of the Russia-Ukraine Conflict

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Abstract

Entrepreneurs are often situated in extreme environments characterized by violent conflict. Yet, war is largely a blind spot in entrepreneurship scholarship. As a first step to closing this gap, we offer a well-identified synthetic control study of entrepreneurial dynamics in the Russo-Ukrainian war. Relative to the synthetic counterfactual, Ukraine's number of self-employed dropped by 20%, and the number of Ukrainian SMEs temporarily dropped by 14% but recovered within five years of the start of the conflict. In contrast, Russia had lost more than 1.4 million SMEs (42%) five years into the conflict. The disappearance of entrepreneurs is driven by both fewer new SMEs created and more existing SME closures. To pave the way for systematic scholarship on "war and entrepreneurship," our study proposes a conceptual framework integrating conflict into the theory of entrepreneurial choice and suggests numerous avenues for future research.

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1.   Introduction

Is war good for the economy? A deeply ingrained conventional wisdom suggests the affirmative: "One of the more enduring myths in Western society is that wars are somehow good for the economy" (Moffatt, 2023) and, similarly, "[o]ne of the enduring beliefs of modern times is that war and its associated military spending has created positive economic outcomes" (Institute for Economics & Peace, 2015). In contrast, empirical evidence of the economic costs of conflict in terms of the GDP per capita suggests a negative effect. The cross-country study by Costalli et al. (2017) estimates that war reduces GDP on average by 17.5%. Existing studies attribute the negative effect of war on GDP to trade disruptions, private investment suspensions, human capital losses, physical capital destruction, technological regress, political instability, and general uncertainty (Abadie and Gardeazabal, 2003; Alesina and Perotti, 1996; Barro, 1991; Glick and Taylor, 2010). This literature has evoked criticism that the focus on GDP as a state variable is not fully informative about conflicts' longer-term consequences for economic dynamics, such as entrepreneurial activity. For example, in their seminal study of the economic costs of conflict, Abadie and Gardeazabal (2003, p. 113) discuss that "entrepreneurs […] had been specific targets of violence and extortion […] However, little research has been carried out to assess the economic effects". Very few studies have dealt explicitly with the impact of conflicts on entrepreneurship.

Unfortunately, military conflicts are not rare events. In the first quarter of 2023, the Armed Conflict Location & Event Data Project (ACLED) reports 8,265 battles, 7,198 occasions of violence against civilians, and 4,559 riots,[1] suggesting that many entrepreneurs experience war not as unique events but as the norm. It appears, therefore, relevant to investigate how conflicts

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[1] https://acleddata.com/dashboard/#/dashboard. Retrieved on April 27, 2023.

relate to the theory of entrepreneurship. Some existing studies have investigated civil strife, so they concentrate on specific regimes or sectors in conflict-ridden countries rather than the overall effects of the conflict, or they focus on specific phenomena, such as necessity or social entrepreneurship (Bozzoli et al., 2013; Brück et al., 2011; Tobias et al., 2016; Collier, 1999; Gimenez-Nadal et al., 2019; Bauer et al., 2016; Voors et al., 2012). Considering that industry associations and policymakers have long warned about the potentially devastating effects of violent conflicts on economic growth through foregone entrepreneurship (Astrov et al., 2022; European Business Association, 2022), the resulting research gap is striking.

In this paper, we build on entrepreneurial choice theory (Evans and Jovanovich, 1989; Xu, 1998; Gans et al., 2019; Agrawal et al., 2021) and focus on four fundamental environmental factors that influence the entrepreneurial choice process, namely freedom, constraints, uncertainty, and noisy learning (Gans et al., 2019). Using this theoretical framework, we identify three "tensions" in individual entrepreneurial choices during wartime. First, the micro vs. macro tension connects the potentially divergent individual and the aggregate effects of war on entrepreneurship. The second and third tensions are about war-induced uncertainty. The second tension contrasts uncertainty as an obstacle vs. an opportunity in that it generates both increased opportunities and entrepreneurial real options as well as increased risk and "Knightian" uncertainty. The third tension considers the time-varying nature of war-induced uncertainty, which evolves from the initial disruption of entrepreneurial activity (pause effect) to possible adjustments or even recovery in later stages (recovery effect). These tensions converge in overarching unaddressed questions: Do violent conflicts between two countries impact aggregate entrepreneurship in those countries? And how long do these effects last?

We estimate the aggregate effects on entrepreneurship in Russia and Ukraine due to the war which erupted with the Russian occupation of the Ukrainian peninsula of Crimea in February

2014. The war is a nearly ideal pre-versus-post comparison because the start of the conflict is widely recognized as an exogenous shock and not endogenously driven by socio-economic tensions between the parties in conflict like many other violent conflicts. Russia and Ukraine have been major trading partners ever since the dissolution of the Soviet Union. The "decision to occupy Crimea was made secretly by Vladimir Putin and a handful of senior security advisors; it took everyone else by surprise" (Korovkin and Makarin, 2023, p. 8). To ensure casual identification of our pre- versus post-war comparison of entrepreneurial activity in Ukraine and Russia, we construct counterfactuals with the Synthetic Control Method (SCM) (Abadie et al., 2010; 2015; Chen et al., 2023). The SCM has been described as "the most important innovation in the policy evaluation literature in the last 15 years" (Athey and Imbens, 2017, p. 9) and is the only viable quasi-experimental method in our empirical context because entrepreneurial activity in Ukraine, Russia, and the control countries have heterogeneous levels and follow non-parallel pre-trends. Thus, only synthetic versions of Ukraine and Russia that mimic entrepreneurial trajectories in these countries are admissible counterfactuals to estimate the causal effect of war.

We examine entrepreneurial activity over a symmetric eleven-year event window around the start of the conflict in 2014. Our balanced annual country-level panel includes Ukraine, Russia, and 45 donor countries. We consider entrepreneurial activity in these countries along two different measures. First, we consider self-employment from nationally representative labor force surveys as the percentage of self-employed of the employed population. Second, we consider SMEs from national registry data as the percentage of registered LLCs of the working-age population. These are standard proxies used to measure entrepreneurship and are complementary (Klapper et al., 2010). While the percentage of registered SMEs only reflects the formal sector, the fraction of self-employed also captures the informal sector. The latter is

important because the shadow economy accounts for more than a quarter of entrepreneurial activity in both Ukraine and Russia (Williams, 2009; Bauer et al., 2016).

Our empirical results suggest that the Russo-Ukrainian war harmed entrepreneurship in both countries. The effect varies in intensity and persistence. The percentage of self-employed in Ukraine dropped sharply by 19.5% in the first conflict year, corresponding to war-induced unemployment of 675 thousand of formerly self-employed Ukrainians. Although this effect partially subsides over time, foregone entrepreneurship proxied by the percentage of self-employed still accounts for 8% (279 thousand Ukrainians) in the fifth conflict year. We check the internal validity of our synthetic control through pre- versus post-war ratios of the mean squared prediction error between countries and in-space placebo tests, and we fail to falsify our model. Analogous to statistical significance tests, we calculate that the probability of estimating an effect as large as ours "by chance" is 3.3%. For self-employment in Russia, the SCM fails to construct a reasonable counterfactual.

The negative war effect is also observable in the fraction of SMEs, although Ukraine and Russia are affected differently. For Ukraine, the difference in SMEs with its synthetic version peaks in 2016, with a gap of 71 thousand SMEs corresponding to a relative loss of 14%. It recovers back to the synthetic trajectory five years into the war. Implied p-values are only significant until 2016 (p-value 8.7%) and non-significant after that, reconfirming the temporary effect. For Russia, in contrast, the effect is persistent and reinforcing. Five years into the conflict, the number of Russian SMEs dropped by 42.2%, accounting for a total loss of 1.4 million. Investigating the sources of the staggering disappearance of Russian SMEs, we find that it is caused by fewer new business creations and, to a larger extent, more existing business closures.

2.   War and Entrepreneurship

Consistent with conventional wisdom and contrary to macroeconomic evidence, most of the few studies on war and entrepreneurship report a positive relationship between violent conflict and entrepreneurial activity (e.g., Bozzoli et al., 2013; Ciarli et al., 2015; Brück et al., 2011), with only a few rebutting studies (e.g., Camacho and Rodriguez, 2012; Deininger, 2003). However, there are concerns about the identification of the conflicts' estimated negative effects on entrepreneurial activity. First, most studies are qualitative and develop a narrative rather than an empirical test of the war-entrepreneurship relation (Brück et al., 2011). They develop local "unit theories" instead of global "programmatic theories" that are of little use "to make clearer and more useful recommendations to leaders and policy-makers" (Aguinis et al., 2022, p. 1671). Second, those studies that are quantitative are often weakly or not at all identified, with only a few exceptions (e.g., Bozzoli, 2013, Ciarli et al., 2015; Camacho and Rodriguez, 2012). A common problem with many empirical studies is that they examine enduring conflicts over truncated sample periods. For example, several studies focus on the domestic strife in Colombia, which started in the 1960s, but consider more recent sample periods that are shorter by an arbitrary amount (e.g., Bozzoli et al., 2013; Gimenez et al., 2019). Any such identified effect might not be causal but rather reflect a "recovery effect" that is documented in post-conflict studies (e.g., Tobias et al., 2016), which could be a root cause for the many (possibly misidentified) positive effects of war in the literature.

2.1   Theory of entrepreneurial choice

Given the absence of a theoretical account of how war impacts entrepreneurship, we build upon the model of entrepreneurial choice (Evans and Jovanovich, 1989; Xu, 1998; Gans et al., 2019;

Agrawal et al., 2021) to derive three fundamental tensions of entrepreneurial choice that individuals face at times of war. The theory of entrepreneurial choice starts from the observation that "for an entrepreneur with an idea, a precondition for selection into entrepreneurship is a (subjective) belief that there is the potential for positive value to be created from that idea" (Gans et al., 2019, p. 741; Shane and Venkataraman, 2000). Provided that this precondition for an individual's entrepreneurial entry is met, latent entrepreneurs implement measures designed to reduce uncertainty about the quality of their idea and the efficacy of their commercialization strategy (Agrawal et al., 2021) that will ultimately result in either the abandonment of the entrepreneurial venture or the choice of a specific entrepreneurial strategy that can range from simple intuition to a rigorous scientific approach (Gans et al., 2019). To better understand the entrepreneurial choice process and to shed some light on how it might be affected by war, it is helpful to discuss four fundamental environmental factors that govern the process: freedom, constraints, uncertainty, and noisy learning (Gans et al., 2019).

Freedom refers to the availability of a broad set of potential commercialization strategies entrepreneurs can choose from to create and capture value. The more disruptive the entrepreneurial project (e.g., starting a venture from scratch versus launching a novel product in an incumbent company), the larger the degree of freedom. In disruptive times of war, when it has been claimed that many new ventures emerge out of necessity by individuals that pursued non-entrepreneurial careers before (e.g., Bozzoli et al., 2013), the level of freedom might be salient, and so are the pressures of certain limitations that come with it, such as limited reputation (MacMillan and Narashima, 1987, Minniti and Bygrave, 2001). Wartime entrepreneurs are often geographically displaced, ripped out of their socio-economic environments, and therefore need to rebuild reputations from scratch (Bozzoli et al., 2013). This mechanism may obstruct entrepreneurial choice, even reducing the realized level of "necessity" entrepreneurship.

Constraints refer to factors that make entrepreneurs prioritize and select among viable alternatives (Gans et al., 2019). Searching and selecting alternatives involves a trade-off between the potential value of additional alternatives discovered if one continues the search process and the search costs (Duffie et al., 2005; Momtaz, 2022). Given that the search process is complicated in times of war (e.g., damaged infrastructure, private investment suspensions, technological regress, and political instability; Abadie and Gardeazabal, 2003; Allesina and Perrotti, 1996; Barro, 1991; Glick and Taylor, 2010), war inflates search costs, leading to fewer identified alternatives, resulting in fewer and worse entrepreneurial choices. The more general war-induced uncertainty further complicates the search problem.

Uncertainty refers to the potential materiality of unknown factors that might impact the value distribution of viable entrepreneurial choice alternatives (Gans et al., 2019). Uncertainty pertains not only to the quality of the venture idea but also to the efficacy of potential commercialization strategies (Agrawal et al., 2021). War may amplify perceived uncertainty about an idea's (product-market) quality because individual tastes and preferences adapt to external circumstances and change during violent conflicts (Voors et al., 2012). At the same time, war may amplify uncertainty about entrepreneurial strategy efficacy because war, at least in the Russo-Ukrainian example (Korovkin and Makarin, 2023), is viewed as an exogenous shock with demand- and supply-side implications for commercialization strategies. Demand-side implications of the Russian invasion of Ukraine comprise reduced purchasing power through either direct GDP effects (Bluszcz and Valente, 2022) or indirect effects via equity valuations (Hoffmann and Neuenkirch, 2017; Boungou and Yatié, 2022), unemployment through business failure and forced displacement (Bozzoli et al., 2013; Costalli et al., 2017), shifting preferences (Voors et al. 2012), and mental health issues (Bai et al., 2022; Kossowska et al., 2023). Supply-side implications include damaged infrastructure, disrupted trade with

international partners, and technological regress, among other things (Astrov et al., 2022; Korovkin and Makarin, 2023). This uncertainty aggravates search and selection among entrepreneurial alternatives, may make search costs prohibitively expensive, and therefore potentially lower the propensity to venture in the first place. Uncertainty about entrepreneurial choice sets and their underlying value distribution also impacts the nature of the entrepreneurial choice process per se through learning from feedback.

Noisy learning refers to learning while avoiding choice commitments, which leads to noisy signals about the quality of ideas and their strategic alternatives. Gans et al. (2019) argue that early positive signals may result in additional choice (inducement effect). Positive news lets entrepreneurs adjust their guessed value distributions upward, increasing the marginal benefits of additional search. In the context of war, we submit that the effect is reversed, leading to less search in the aggregate. Uncertainty is high at times of war and increases the signal's noise content. Also, news during the war often comes as exogenous shocks until a turning point has been reached in the war (at least for the "winning" party), more often negative than positive. Thus, wartime entrepreneurs are plausibly more likely that the first signal is non-positive, paired with the inflated search costs due to the heightened noise level; this may reduce search effort and the abandonment of an entrepreneurial idea (deterrence effect).

War impacts the entrepreneurial choice problem of most if not all, types of entrepreneurs, including opportunity and necessity entrepreneurs. Some scholars attribute war's frequently positively estimated effect on entrepreneurial activity to a rise in necessity entrepreneurship after forced displacement (Brueck et al., 2011; Bozzoli et al., 2013). However, this view is contested (e.g., Ciarli et al., 2015). To clarify the debate, we suggest distinguishing between the impact of war on entrepreneurship in conflict-ridden vis-à-vis peaceful regions.

First, it seems likely that war increases aggregate levels of entrepreneurship in peaceful regions because refugees, for lack of employability in established firms abroad (e.g., because of language barriers or difficulties in obtaining work visas), are necessitated to enter self-employment. Given the real and plausibly subjectively even higher perceived improvement in the prerequisites of entrepreneurial entry (i.e., more freedom, fewer constraints and uncertainty, and more precise signals), the theory of entrepreneurial choice is consistent with the view that war promotes entrepreneurship in peaceful regions far away from the war (Gans et al., 2019), which is documented in the refugee entrepreneurship literature (for recent reviews, see Desai et al., 2021; Abebe, 2023).

Second, it seems equally likely that war decreases the aggregate levels of entrepreneurship in conflict-ridden regions. Abadie and Gardeazabal (2003) note that attackers often explicitly target entrepreneurs in violent conflicts. This view aligns with Astrov et al. (2022) and the European Business Association (2022), who document that the Russian war against Ukraine severely harms Ukrainian entrepreneurs by providing a targeted attacking tactic to destroy markets and infrastructure. The recent motivational theory of entrepreneurial choice helps us understand why such entrepreneurial targeting destroys existing and deters latent entrepreneurship. Dencker et al. (2019) and Coffman and Sunny (2021) build on Maskow's (1954) hierarchy of needs to draw demarcation lines between necessity and opportunity entrepreneurship. Their work suggests that war may even reduce necessity entrepreneurship in regions at war because conflict threatens the most basic needs (i.e., physiological and safety), further reinforced by entrepreneurial targeting by attacking countries.

The discussion leads us to conclude that there are at least three fundamental "tensions" that shape how war impacts entrepreneurial activity: a micro (focus on individuals) versus macro (focus on countries) perspective, uncertainty as a doubled-edged source of entrepreneurial

obstacles, and opportunities, and the time-varying character of war-induced uncertainty evolving from the initial shock.

2.2   Micro vs. Macro Perspective

The first tension describes the potentially diverging effects of war on individual-level versus country-level entrepreneurship. Two distinct streams of the literature suggest that if a population of individuals is affected by an outbreak of war, an individual's propensity to become an entrepreneur increases. The conflict literature suggests, among other things, that displacement from conflict regions to peaceful regions increases the probability of self-employment (e.g., Bozzoli et al., 2013), and war promotes female entrepreneurship to secure the survival of families (Anugwom, 2012). The refugee entrepreneurship literature suggests that refugee entrepreneurship is desirable because it facilitates personal adaptation (Thorgren and Williams, 2023; Jiang et al., 2021; Backmann et al., 2021) and resilience to adversity (Shepherd et al., 2020), as well as that immigrant entrepreneurship has positive effects over several generations (Yassin and Hafeez 2023). In contrast, the entrepreneurship-inducing war effect at the individual level is likely reversed at the country or aggregate level, as policy work by the European Business Association (2022) indicates. Attacking countries' entrepreneurial targeting tactics may accelerate entrepreneurial exit (Abadie and Gardeazabal, 2003; Camacho and Rodriguez, 2012) and deter entrepreneurial entry by latent entrepreneurs (Deininger, 2003; Chowdhury, 2011) because it threatens individuals in their most basic needs (Dencker et al., 2019; Coffman and Sunny, 2021). This effect may lead to a decrease in entrepreneurship in attacked countries and an increase in peaceful countries indirectly impacted by the war through refugee immigration. However, the literature lacks evidence of how entrepreneurship changes in times of war at the country level. In fact, of 19 reviewed papers in the conflict literature and

the eight reviewed papers in the (refugee) entrepreneurship literature for this study, all took the individual as the unit of analysis; none investigated the aggregate (country) level.

2.3   Uncertainty as an Obstacle vs. an Opportunity

The second tension pertains to the nature of war-induced uncertainty as a double-edged source of obstacles to entrepreneurship and entrepreneurial opportunities. On the one hand, uncertainty may create entrepreneurial opportunities (Schumpeter, 1939; 1943). Entrepreneurial opportunity, broadly defined, arises if uncertainty about objectives that matter to some in the economy leads to a risk that entrepreneurs can manage (Knight, 1922). War creates substantial uncertainty (e.g., the bombing of several Ukrainian cities by the Russian military threatens that all Ukrainians have shelter, electricity, and food, or the war creates the risk that Ukraine may not have enough arms to defend its sovereignty). For entrepreneurs, these risks create opportunities, e.g., securing shelter, electricity, food, and arms. In real options theory (Myers, 1977), the amplified set of entrepreneurial opportunities brought by the increased uncertainty constitutes a valuable entrepreneurial real option.

Conversely, war-induced uncertainty, i.e., Knightian uncertainty that is difficult to measure, as opposed to measurable risk, can obstruct entrepreneurs (Bullough et al., 2014; Audretsch and Moog, 2022). Through the lens of entrepreneurial choice theory (Gans et al., 2019; Agrawal et al., 2021), war-induced uncertainty amplifies the more general entrepreneurial uncertainty about the venture's quality and the commercialization strategy's efficacy, which increases the noisiness with which entrepreneurs test the fit of their ideas with product markets. Moreover, unlike the general entrepreneurial uncertainty that is, by assumption, normally distributed around a neutral mean of the entrepreneurial value distribution, war-induced uncertainty skews

the distribution toward adverse outcomes because of the adversity of uncertain events, eventually choking entrepreneurship.

2.4   *Time-varying war-induced uncertainty*

The third tension refers to the time-varying nature of war-induced uncertainty. The outbreak of war is a shock that increases economic uncertainty in an erratic way (Korovkin and Makarin, 2023); it is a disruption that is often orthogonal to expectations and creates fear about the future evolution of the conflict. As the war continues, news disseminates, among other things, about the country's relative defensive strength and the severeness of the war in terms of casualties, displacements, infrastructure damage, and so forth, which lets people adjust to a "new normal" (Astrov et al., 2022). With time and information, war-induced uncertainty evolves from the non-quantifiable notion of impending evil to a (better-)quantifiable risk that may pave the way for entrepreneurial opportunities (see the second tension above). Indeed, numerous studies suggest that war impacts entrepreneurship heterogeneously over a war's lifecycle. For example, Bullough et al. (2014) find that perceived danger negatively correlates with entrepreneurial intentions in Afghanistan during high levels of war-induced uncertainty. In contrast, Tobias et al. (2013) find that entrepreneurship flourishes in the post-war period in Rwanda, and Nillesen and Verwimp (2010) document that farmers adjust to a "new normal" and start to diversify their income sources according to the conflict development during the late-stage and post-war period in Burundi. Therefore, the evidence suggests that war-induced uncertainty might stop entrepreneurial activity initially (pause effect), plausibly followed by a recovery in later stages and post-war periods (recovery effect).

3.   Empirical Design and Results

3.1   *Institutional background: The Russo-Ukrainian conflict*

Ukraine is located in Eastern Europe, has a population of roughly 40 million inhabitants, and, with a geographic area of more than 600,000 square kilometers, it is the largest country contained within the borders of the European continent. Ukraine gained sovereignty as an independent nation in 1917 and became part of the Soviet Union after WWI. At the end of WWII, Soviet dictator Stalin negotiated with the United Nations to include Ukraine as the Ukrainian Soviet Socialist Republic in the Soviet Union. Crimea was part of the Russian Soviet Federative Socialist Republic until 1954, when Nikita Khrushchev, First Secretary of the Communist Party of the Soviet Union, transferred it to the Ukrainian Soviet Socialist Republic at the 300th anniversary of the Treaty of Pereiaslav, an agreement that secured Cossack Hetmanate, a predecessor state of Ukraine, the military protection of the Tsardom of Russia. With the dissolution of the Soviet Union, Ukraine regained national sovereignty and reorganized Crimea as a de-jure autonomous republic in 1995. In February 2014, Russia invaded Crimea and organized a referendum declaring independence from Ukraine. As per UN Resolution 68/262 of March 27, 2014, most UN member states view the referendum as illegal and condemn the Russian occupation as violating the law of nations.

Russia-commanded armed para-military troops also subdued the municipal administrations of Ukrainian cities Donetsk and Luhansk in April 2014, initiating the war in Donbas (the farthest Eastern Ukrainian territory bordering Russia). The Office of the United Nations High Commissioner for Human Rights (OHCHR) declared the "total collapse of law and order" in the Donbas region in July 2014. Until Russia launched its full-scale armed invasion of Ukraine in February 2022, which characterizes the current state of the Russo-Ukrainian conflict, the

United Nations (2022) estimated more than 14,000 casualties in the Donbas region, with more than 3,000 civilian victims. The number of displaced Ukrainians amounts to several million. Importantly, Ukraine and Russia were major trading partners until the war, with tariffs set to zero. Between two years before the conflict and two years after it ended, Ukrainian exports and imports to and from Russia, which comprised a quarter of all exports and a third of all imports, fell by 61% and 60%, respectively.

A recent survey by Kraemer-Eis et al. (2023) finds that the market sentiment declined after the Russian offensive war against Ukraine, with European venture capitalists becoming more risk-averse and less willing to invest, while their portfolio companies face product-related, market, and operational challenges as a result of the war and the new macroeconomic and geopolitical situation. Liadze et al. (2022) estimate that the impact of the war is equivalent to 1% of global GDP in 2022 compared with our GDP forecast made by the National Institute of Economic and Social Research.

3.2   Sample and Summary Statistics

To estimate the conflict's impact on entrepreneurship, we construct a balanced annual country-level panel for the 2009-2019 period for Ukraine and Russia and for 45 "donor pool" countries, for which data on the two outcome variables and eight predictors of entrepreneurial activity are available. The donor pool includes all countries plausibly related to Ukraine and Russia either through the former joint membership in the Soviet Union or through their satellite status (e.g., Poland, Hungary, and Bulgaria), as well as other countries on the Eurasian continent and elsewhere. Table 2 below lists all donor countries used to construct synthetic versions of Ukraine and Russia.

We focus on two outcome variables to capture country-level entrepreneurial activity. First, we examine *the percentage of self-employed of total employment* from the *International Labor Organization's ILOSTAT database*[2], which gathers annual data on the number of self-employed from nationally representative labor force surveys. Second, we explore *the percentage of registered LLCs of the working-age population* from the *World Bank Entrepreneurship Database*[3], which gathers annual SME data from business registries. The self-employment variable measures entrepreneurship in the *formal* and *informal* sectors, while the SME variable measures entrepreneurship only in the formal sector.

Summary statistics for the two outcome variables for Ukraine, Russia, and the donor pool are in Table 1. The percentage of self-employed decreased from 18.64% to 15.80% from the pre- to the post-invasion period in Ukraine, with the 2.84% difference in means corresponding to 1.13 million Ukrainians being statistically highly significant. The average percentage of self-employed also decreased in Russia by 0.41% (0.18 million Russians) and in the donor pool by 1.46%, albeit statistically non-significant. In contrast, the percentage of registered SMEs increased statistically significantly by 0.37% (99.29 thousand Ukrainian SMEs), 0.36% (251.16 thousand Russian SMEs), and 1.21% (125.98 thousand SMEs in donor pool countries) in the post-invasion period.

[PLEASE INSERT TABLE 1 ABOUT HERE]

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[2] See, for further details, https://ilostat.ilo.org/topics/employment/, retrieved from the World Bank (https://data.worldbank.org/indicator/SL.EMP.SELF.ZS) in June 2022.
[3] The data was retrieved from www.worldbank.org/en/programs/entrepreneurship, which collects data from national business registries, in June 2022. We manually checked the official statistics in Ukraine and Russia. We identified differences in the Ukrainian statistics for the number of LLCs in some years. In these cases, we decided to go with the Official Accounts of Ukraine.

We explain these outcome variables with eight covariates, including GDP per capita, GDP growth, FDI net inflows, a proxy for the ease of starting a business, domestic credit to the private sector as a percentage of GDP, unemployment, R&D expenditure, and patent applications by residents. Variable definitions and summary statistics are in Table A.1 in the Appendix.[4] The average percentages of self-employment and registered SMEs for the full sample (Russia, Ukraine, and the donor pool) are 5.68% (pre-invasion: 5.12%, post-invasion: 6.30%) and 22.45% (pre-invasion: 23.12%, post-invasion: 21.65%), which starkly contrast with those for Ukraine and Russia in Table 1, and therefore highlight the need to carefully select controls for the counterfactuals.

3.3   Research Design: Synthetic Control Method

The summary statistics in Table 1 might (misleadingly) suggest that the Russian invasion of Ukraine had a negative effect only on self-employment in Ukraine and positive effects on the number of registered SMEs in Ukraine and Russia. Such an inference might, in reality, just reflect ambiguity in how control countries were chosen and their ability to reproduce the outcome trajectory of the counterfactual, which is a common problem in comparative case studies (Abadie et al., 2010). Figure 1 illustrates the problem. Panel a shows the trends in the percentage of self-employed, and Panel b shows the trends in the percentage of registered SMEs over the 2009-2019 sample period. These plots suggest that the full donor pool is a poor control group for Ukraine and Russia because the levels in both variables vary significantly across the three groups, and even pre-invasion, the donor pool trends are not parallel to those of Ukraine and Russia. For example, for self-employment, the donor pool monotonically decreases at

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[4] We considered a battery of 18 covariates during the synthetic control construction process, but found the aforementioned eight covariates to lead to the most robust synthetic countries. The additional variables included inflation, mobile cellular subscriptions, branches of commercial banks, the resolving insolvency score, as well as the six World Bank Governance Indicators. All data was retrieved from World Bank in June 2022.

almost a constant rate from 25% to about 21% over the sample period, while Ukraine's trend is increasing from 17% to 20% in the pre-invasion period.

[PLEASE INSERT FIGURE 1 ABOUT HERE]

We address these problems with the SCM (Abadie and Gardeazabal, 2003; Abadie et al., 2010; Abadie et al., 2015). We construct synthetic Ukraine and Russia as linear convex combinations of countries in the donor pool that most closely resemble the countries regarding the pre-invasion predictors of self-employment and the number of registered SMEs. Self-employment for synthetic Ukraine is predicted by pre-invasion country-level characteristic means for (i) GDP growth, (ii) unemployment, and (iii) domestic credit. The synthetic version (i=-0.37%, ii=10.71%, iii=71.35) tracks Ukraine (i=-0.52%, ii=7.64%, iii=75.63) much better than the donor pool (i=1.66%, ii=9.48%, iii=85.1). The tracking error, measured as the absolute percentage deviation of Ukraine's self-employment predictor means between the synthetic version and the donor pool, reduces by almost 85% in synthetic Ukraine. In contrast, we cannot construct a synthetic Russia that sufficiently tracks self-employment's pre-invasion evolution trajectory (see Section 2.4.2).

Pre-invasion percentages of registered SMEs in Ukraine and Russia can be tracked closely by (i) FDI, (ii) the World Bank's starting-a-business score, (iii) R&D expenditures, and (iv) residential patent applications. For Ukraine (i=$6.97 billion, ii=73.33, iii=0.80, iv=2,635), the synthetic version (i=$7.04 billion, ii=73.33, iii=0.80, iv=2,642) is much better than the donor pool average (i=$16.02 billion, ii=85.09, iii=1.44, iv=12,424). For Russia (i=$54.90 billion, ii=88.60, iii=1.08, iv=27,666), the synthetic version is comparable to the donor pool average. The synthetic countries are constructed based on the weights of donor pool countries shown in Table 2. Self-employment trends in pre-invasion Ukraine are best reproduced by Slovenia

(42%), Estonia (37%), and Armenia (19%); SMEs trends in pre-invasion Ukraine are best reproduced by Tajikistan (45%), India (15%), Austria (11%), and SME trends in pre-invasion Russia are best reproduced by Denmark (36%), Serbia (22%), Bulgaria (20%), in addition to several donor countries with smaller weights.

[PLEASE INSERT TABLE 2 ABOUT HERE]

3.4   Results

3.4.1   Self-employment: Ukraine versus Synthetic Ukraine

Panel a of Figure 2 displays self-employment as a percentage of total employment for Ukraine and its synthetic counterpart during the 2009-2019 sample period. The pre-invasion trends for Ukraine and its synthetic version are reassuring. In contrast to the trend differences between Ukraine and the donor pool in Figure 1, self-employment in synthetic Ukraine closely tracks the trajectory of self-employment in Ukraine for the pre-invasion period. The minor pre-invasion tracking error suggests that synthetic Ukraine represents a reasonable approximation to the percentage of Ukrainian self-employed had Russia not invaded Ukraine in 2014.

The estimated causal effect of the Russian invasion of Ukraine on self-employment is the difference between the percentage of self-employed in Ukraine and its synthetic equivalent in the post-invasion period. Self-employment in Ukraine drops sharply after the invasion from about 3.46 million to 2.61 million, representing a relative loss of 19.5%, and stays at this level for the remainder of the sample period. Self-employment in synthetic Ukraine also decreases in the 2016-2019 period. The relative difference is decreasing, suggesting that self-employment in Ukraine recovered from the initial shock of the invasion in the post-invasion period, starting

in the second post-invasion year in 2016. Panel b makes this notion explicit by plotting the annual gaps in self-employment between Ukraine and synthetic Ukraine, with the estimated effect for synthetic Ukraine normalized to zero. Panel b suggests that the total loss in self-employed Ukrainians gradually decreased in the following years to 492,995 (-14.3%) in the year 2016; 362,896 (-10.5%) in 2017; 370,118 (-10.7%) in 2018; and 278,553 (-8.1%) in 2019. In the hypothetical scenario that the recovery path of self-employment in Ukraine would continue without interruption (i.e., ignoring the further escalation in 2022), Ukraine would break even with synthetic Ukraine nine years into the conflict.

To evaluate the significance of our estimated effect of the Russian invasion on self-employment in Ukraine, we cannot rely on statistical significance tests because the invasion lacks randomization (Abadie et al., 2010; 2015). Instead, a viable alternative approach to assess the significance of the identified effect is to explore whether the effect could be entirely driven by chance, using placebo tests. As in Abadie and Gardeazabal (2003), we estimate "in-space placebo tests" by applying the SCM to non-invaded non-invading countries in the donor pool. The placebo tests would falsify our interpretation that the Russian invasion caused the decrease in Ukrainian self-employment if they would lead to estimated gaps between synthetic and actual countries that are similar in magnitude to that estimated for Ukraine.

Panel c plots the placebo tests for donor-pool countries with Mean Squared Prediction Error (MSPE) between self-employment in an actual country and its synthetic version during the pre-invasion period of less than or equal to ten times that of Ukraine to ensure that the tests are not contaminated by synthetic versions of control countries that cannot be reproduced with our variables and/or donor pool (Abadie et al., 2010). The gray lines correspond to the gaps associated with individual donor pool countries, while the black line corresponds to the estimated annual self-employment gaps in Ukraine. Panel c suggests that the gap for Ukraine

is relatively large compared to those for the countries in the donor pool. The placebo tests indicate that the probability of obtaining an effect as large as the immediate effect of the Russian invasion on self-employment in Ukraine in 2015 when the invasion status is reassigned at random in our data is $1/30 = 0.033$ (i.e., the number of placebo effects exceeding that of Ukraine in 2015 divided by the number of all estimated effects; see Abadie et al., 2015, p. 500). Finally, in unreported results, we find that the ratio of post- and pre-invasion MSPEs for Ukraine exceeds that of the donor-pool countries. The post-invasion MSPE is more than 100 times as large as that for the pre-invasion period for Ukraine. No country in the donor pool has a larger MSPE ratio, reconfirming the significance of the war's effect on self-employment in Ukraine.

[PLEASE INSERT FIGURE 2 ABOUT HERE]

3.4.2   Self-employment: Russia versus Synthetic Russia

We also tried to estimate the effect of the invasion on self-employment in Russia. However, no combination of our donor pool countries reproduces Russian self-employment in the pre-invasion period reasonably well. Therefore, the analysis is shown in Figure IA.1 in the Internet Appendix for brevity.

3.4.3   SMEs: Ukraine versus Synthetic Ukraine

Turning to the invasion's effect on registered SMEs, we first discuss the evidence for Ukraine. Figure 3 shows trends in the percentage of SMEs relative to the working-age population for Ukraine and its synthetic version, the annual gap between the two, and placebo tests. Again, there is little variation in the pre-invasion period. Compared to the trend differences between Ukraine and the donor pool in Figure 1, the evolution of SMEs in synthetic Ukraine closely

tracks that of Ukraine in the pre-invasion period. Trends diverge in the year of the invasion. The annual gap reaches its maximum two years after the invasion and then climbs back to the counterfactual trajectory for the synthetic country in 2019, indicating a full recovery period of three years. The 2016 effect peak corresponds to a temporary dip in SMEs of 14%. In absolute terms, the total number of registered SMEs in Ukraine is 489,626, and the implied number for synthetic Ukraine is 560,378, which indicates that the Russian invasion cost Ukraine 70,752 registered SMEs by 2016.

In-space placebo effects for all countries in the donor pool with a pre- versus post-MSPE ratio below 10 (leaving 23 countries) are in Panel c. The probability of obtaining an effect larger than that estimated for Ukraine in 2016 by randomly assigning the invasion status to countries in the donor pool is 8.7% (=2/23). In contrast, the corresponding probability for 2019 is 56.5% (=13/23). The placebo tests thus support our inference that the Russian invasion had a temporary and significant effect on the number of registered SMEs in Ukraine in 2016, but the effect did not persist and was non-significant with a probability of 26.1% (=6/23) in 2017, and it fully subsided over the next three years.

3.4.4   SMEs: Russia versus Synthetic Russia

The patterns for registered SMEs as a percentage of the working-age population in Russia contrast with those estimated in Ukraine. Panels a and b of Figure 3 indicate that the Russian invasion of Ukraine did not immediately impact SMEs in Russia but had a very strong impact after the first two years following the invasion. Pre-invasion trends between Russia and its synthetic version a very similar. These trends diverge slightly in the two post-invasion years, but the difference is insignificant. The annual gap in 2016 has a 21.6% probability of being estimated at random according to the placebo tests in Panel c. The percentage of registered SMEs in Russia

decreased dramatically over the 2017 to 2019 period. The placebo tests suggest that the chance of obtaining an effect as large as the 2019 one at random is 8.1% (=3/37). Therefore, these results suggest that the effect on Russian SMEs lags but is very pronounced in the long term, with potentially even higher rates after the end of our sample period in 2019. As for the absolute values, in the last year of our analysis, the number of Russian SMEs was 3.3 million, whereas according to Synthetic Russia, this number would have been 4.8 million. Thus, in the absence of war, the implied gap of 1.4 million corresponds to a relative loss of 42%.

[PLEASE INSERT FIGURE 3 ABOUT HERE]

3.5   Additional Results: Birth and death rates of Russian SMEs

The World Bank Entrepreneurship Database also provides information on registered SMEs' birth and death rates, unfortunately only in Russia and not Ukraine. We leverage the data here to shed light on the mechanics behind the disappearance of SMEs in Russia. Unfortunately, the data are not available for Ukraine. For both Russian SMEs' birth and death rates, we create synthetic versions of Russia and compare the post-invasion trends in Figure 4. At the end of our sample period in 2019, the Russian SME birth rate is down one-third, and the death rate is increased by a factor of 2.5 relative to the synthetic versions, indicating that the disappearance of Russian SMEs is driven by both fewer newly created businesses and (to a larger extent) more existing business closures.

[PLEASE INSERT FIGURE 4 ABOUT HERE]

4.   Discussion and Concluding Remarks

4.1   Summary of Main Findings

Does violent conflict impact entrepreneurship? Although the question has started attracting attention, war's aggregate impact on entrepreneurial activity in conflict-ridden countries is underexplored. Motivated by this research gap, we investigate how the Russo-Ukrainian war erupted with the Russian occupation of the Ukrainian peninsula of Crimea in February 2014 and affected aggregate counts of self-employed and registered SMEs in Ukraine and Russia. Employing the Synthetic Control Method (SCM) to construct synthetic versions of Ukraine and Russia as counterfactuals, we find that the war dramatically negatively affected self-employment as a percentage of total employment in Ukraine. The fraction of self-employed dropped by 19.5% when the conflict erupted, corresponding to 674.5 thousand Ukrainians. Although Ukrainian self-employment partially recovered subsequently, we estimate that foregone entrepreneurship associated with solo entrepreneurs still amounted to 8% five years into the conflict. Our evidence for SMEs sheds additional light on the war's impact. The war hit Ukrainian SMEs only temporarily. Although 70.8 thousand SMEs accounting for 14% of all Ukrainian SMEs were lost immediately following the conflict's outbreak, Ukraine recovered fully within five years. In contrast, Russian SMEs were hit stronger and never recovered. Five years into the conflict, Russia had foregone entrepreneurial activity of 1.4 million SMEs, a staggering 42% loss. Further, investigating the sources of the disappearance of Russian SMEs, we show that fewer new business creations and (to a larger extent) more existing business closures drive the effect.

4.2   Theoretical Contributions

To our knowledge, this is the first synthetic control study that quantifies the economic costs of conflict in terms of aggregate foregone entrepreneurship. Our study contributes to four distinct streams in the literature.

First, we contribute to the growing evidence on the economic costs of conflict (e.g., Abadie and Gardeazabal, 2003; de Groot et al., 2022) by expanding the set of examined outcomes from GDP per capita to lost entrepreneurship. Given that the contributions of entrepreneurship to GDP are heterogeneous across countries – e.g., entrepreneurship's value added is 20% in Russia and 53% in Ukraine (Statista, 2022; European Commission, 2021) – our results explain why war impacts countries' GDPs so differently. Further, given that nascent entrepreneurship's value-added materializes with a lag between starting up and being profitable, our study also helps explain why GDP recovers with delays after conflicts (Costalli et al., 2017).

Second, our study contributes to the literature on conflict and entrepreneurship that has so far focused on specific aspects of how conflict impacts entrepreneurship, such as displacements and necessity entrepreneurship (e.g., Bozzoli et al., 2013) and social entrepreneurship (Gimenez-Nadal et al., 2019; Bauer et al., 2016). Our study provides an account of the aggregate negative impact of the Russia-Ukraine conflict on entrepreneurship in both countries and challenges the majority of evidence arguing that conflict impacts entrepreneurship in a positive way.

Third, our study also informs the broader entrepreneurial choice literature by delineating how war shapes the evaluation of entrepreneurial ideas and strategies. Drawing on the axiomatic work of Gans et al. (2019), we develop theoretical arguments about how war might impact the four conditions for entrepreneuring. In particular, war curtails individual freedom, imposes additional constraints, and induces tremendous uncertainty, all of which shift the perceived

value distribution of a new venture's expected payoffs downward; war leads to more noisy and negative signals and ultimately to a higher propensity of abandoning a new venture idea in conflict-ridden countries.

Fourth, we contribute to the recent body of work on the Russo-Ukrainian war (Astrov et al., 2022, for a review). While no study has studied the entrepreneurial ramifications of the war so far, existing work quantifies the economic costs of the war and potential sources. In particular, our work is closely related to Bluszcz and Valente's (2022) synthetic control study of Ukrainian GDP, whose estimated effects are similar to ours, as well as Korovkin and Makarin (2023) and Hoffmann and Neuenkirch (2017) who show that sources of decreased GDP include trade and financial market frictions, respectively. Further, the disappearance of entrepreneurial activity might be one factor behind the identified mental health consequences of the Russo-Ukrainian war (Bai et al., 2022; Chudzicka-Czupała et al., 2023; Jawaid et al., 2022; Kossowska et al., 2023).

4.3   Policy Implications

Our results have potentially important implications for policymakers. The overall conclusion from our study is that the Russo-Ukrainian war inhibits entrepreneurial activity, which results from both lower birth and higher death rates of SMEs. Policymakers may help dampen the negative effects of war for entrepreneurs in at least the following (non-military) ways.

First, there are some general ways in which policymaking may help improve the resilience of entrepreneurs to the consequences of war. For example, policymakers may help existing entrepreneurs to improve their resilience to the increased risk of failure, inter alia, by stabilizing demand through diversifying into new markets and increasing their resilience to supply chain

shocks. New-market diversification may be facilitated by subsidy programs that stimulate new product development and launches and new cross-border cooperations (Zahra, 2022). Policymakers may help manage supply chain interruptions by negotiating prices and quantities of necessary goods and services with new partners in neutral or allied countries and using financial support from the international community to subsidize supply that would otherwise be prohibitively costly due to the war. Moreover, to mitigate the war's negative impact on the birth rate of new ventures, policymakers could nudge potential entrepreneurs into venturing, e.g., through subsidy programs.

Second, there are some ways in which policymaking may help improve the resilience of entrepreneurs in the specific context of the Russo-Ukrainian conflict. Two particularities of the Russo-Ukrainian war are that Russia damaged significant parts of Ukraine's electricity infrastructure at the very beginning of the war and that Ukraine's major partner in international trade was Russia until the outbreak of the war (Astrov et al., 2022; Korovkin and Makarin, 2023). Therefore, policymakers can support existing entrepreneurs during the Russia-Ukraine conflict, e.g., by managing energy costs and ensuring a steady supply of input factors threatened by the supply chain interruptions when trade with Russia plummeted.

4.4   Limitations and Avenues for Future Research

Our study represents a first step toward understanding how war impacts entrepreneurship. Given the nascency of the research question, the shortage of available data, and the necessary high level of abstraction in our synthetic control analysis, our study is subject to several limitations and offers, at the same time, a starting point for future research of both theoretical and empirical nature.

Our empirical analyses are limited in two relevant ways. First, the SCM identifying assumption is that there is no interference between countries ("no spillover assumption"). However, the Russo-Ukrainian war might have affected entrepreneurship also in other countries, e.g., by deterring international ventures (Zahra, 2022) and cross-border activity (Welter et al., 2018) or by increasing refugee entrepreneurship by displaced Ukrainians and emigrant Russians in unaffected countries (Jiang et al., 2021; Shepherd et al., 2020; Thorgren and Williams, 2023). Unfortunately, data on migration streams of displaced people is not available at an aggregate level. Second, the absence of war casualties and displacements in donor pool countries might bias the synthetic controls. Note, however, that both caveats would cause our estimates to be conservative. Additionally, we failed to construct a synthetic version of Russia concerning the self-employment variable (possibly due to the idiosyncratic system of "blat" in Russia, see Aidis et al., 2008; Puffer et al., 2010). The flip side of these limitations is that they imply interesting avenues for promising future research.

Future research could examine how war impacts entrepreneurship in the attacked, the attacking, and unaffected countries at the country and regional levels, considering the roles of displaced and emigrant people. For example, our findings suggest that Ukrainian entrepreneurship recovered and Russian entrepreneurship continuously diminished. The question of how the support for Ukraine from the international community and sanctions against Russia moderated these observed patterns is left to future research (and a different research design). Moreover, Ukraine was not uniformly impacted by the Russian war; some geographic regions were more affected than others (Astrov et al., 2022). It is therefore important to better understand the spatial variation in war consequences for entrepreneurs.

Similarly, little is known about the treatment effect heterogeneity of the war in different product markets. Prior research documents that service and non-service sectors might be differently

impacted by war (Bozzoli et al., 2013; Ciarli et al., 2015). Finally, not every war is the same. Indeed, Costalli et al. (2017) document substantial heterogeneity in how different wars affect GDP. Examining a multi-war sample and the resulting treatment effect heterogeneity seems very promising. Unfortunately, there is no systematic data that would enable researchers to address these open questions. Thus, we feel that collaborations with governments or industry associations to obtain access to administrative data or implement a representative survey seem best suited to address these topics.

Numerous open questions also remain at the individual level that spans topics such as the impact of war on latent entrepreneur's entrepreneurial choice and entry; on existing entrepreneur's execution and survival or exit; on the antecedents, performance, and consequences of perseverance entrepreneurship in attacked and attacking countries, entrepreneurship from refugees from attacked countries in third countries, and entrepreneurship from emigrants from attacking countries in third countries. The refugee entrepreneurship literature, as reviewed by Abebe (2023) and Desai et al. (2021), has established several insights and methods for the realm of refugee entrepreneurs in third countries. For example, refugee entrepreneurship may facilitate personal adaptation (Thorgren and Williams, 2023) and adversity management (Shepherd et al., 2020), differs in the degree the entrepreneurial process is structured (Jiang et al., 2021), helps with the integration of refugees in foreign labor markets (Backmann et al., 2021), and depends on the availability of (financial) support for refugees (ama et al., 2023). Expanding these research agendas from the refugee focus to foci about perseverance and emigrant entrepreneurship would be interesting.

Finally, several action-oriented open questions could help policymakers improve the efficacy of support and sanction programs targeted at attacked and attacking countries. First and foremost, understanding the various support programs available to policymakers to mitigate the

detrimental consequences of war on entrepreneurship is an important open question that merits further research. This line of research could also investigate the potential mechanisms behind the conflict's negative effect on entrepreneurship, such as the relative importance of operational, financial, and human capital-related constraints at times of war, which is left to future research. Moreover, the results of this paper suggest that the loss of entrepreneurial activity in the Russia-Ukraine war may take generations to overcome. How long this process takes and potential ways to shorten the time period also warrant further research.

4.5   Concluding Remarks

This study has sought to inform the question of how war impacts entrepreneurship. We offer the first synthetic control study in the entrepreneurship literature to quantify lost entrepreneurship in terms of self-employment and SMEs in Ukraine and Russia since the Russian occupation of the Ukrainian peninsula of Crime in 2014. The results suggest that the war decreased aggregate levels of entrepreneurship in both countries. While Ukrainian entrepreneurship seems to have recovered after the initial shock, Russian entrepreneurship diminished over the entire observation period. Our paper also offers a conceptual framework grounded in the theory of entrepreneurial choice to guide further theoretical and empirical work on the war-entrepreneurship relation. Evidently, we are just beginning to understand the complicated ways war impacts entrepreneurship (and how entrepreneurship might contribute to post-war recovery), and therefore hope to spark further work on this important and understudied topic.

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Exhibits

Table 1: Pre- and post-conflict entrepreneurship in Ukraine, Russia, and the donor pool

	Pre-invasion		Post-invasion		Diff. in means
	Mean	St. Dev.	Mean	St. Dev.	t-stat
Panel a: Ukraine					
Self-employed, in million	3.71	0.04	2.59	0.2	-1.13***
Self-employed, in % of total employment	18.64	0.72	15.80	0.12	-2.84***
SMEs, in thousand	450.58	51.15	549.87	55.85	99.29**
SMEs, in % of working-age population	1.41	0.17	1.78	0.21	0.37**
Panel b: Russia					
Self-employed, in million	5.28	0.05	5.10	0.25	-0.18
Self-employed, in % of total employment	7.47	0.78	7.06	0.34	-0.41
SMEs, in thousand	3,430.6	257.71	3,681.7	233.77	251.16
SMEs, in % of working-age population	3.35	0.26	3.71	0.19	0.36**
Panel c: Donor pool					
Self-employed, in million	8.79	45.17	8.12	40.63	-6.69
Self-employed, in % of total employment	23.57	17.25	22.10	16.17	-1.46
SMEs, in thousand	439.12	613.45	565.1	787.05	125.98*
SMEs, in % of working-age population	5.24	5.15	6.46	5.32	1.21**

Figure 1: Non-parallel country trends and heterogenous levels of entrepreneurship

Panel a: Self-employment
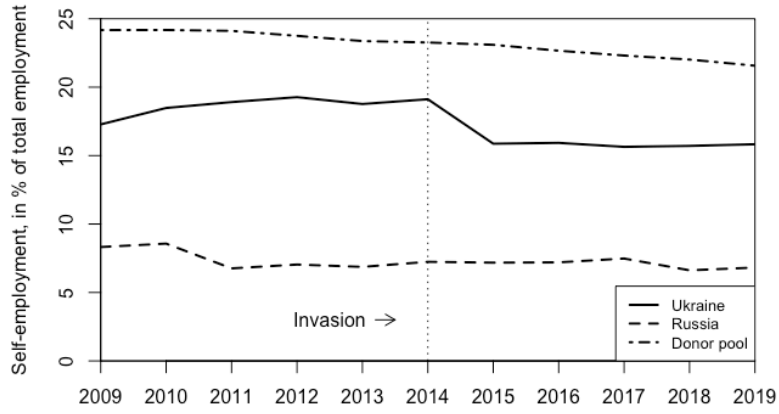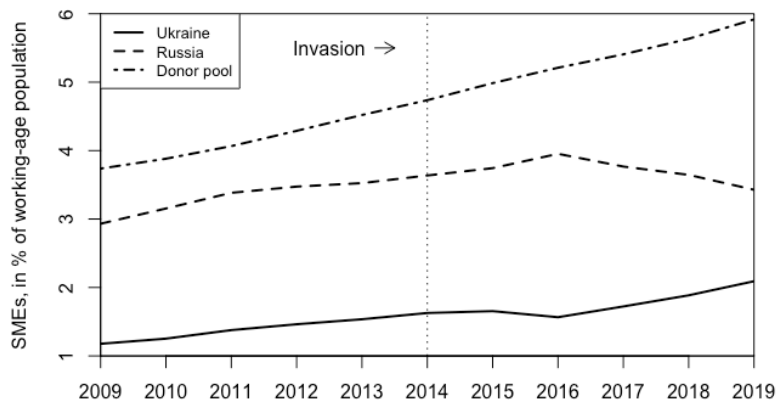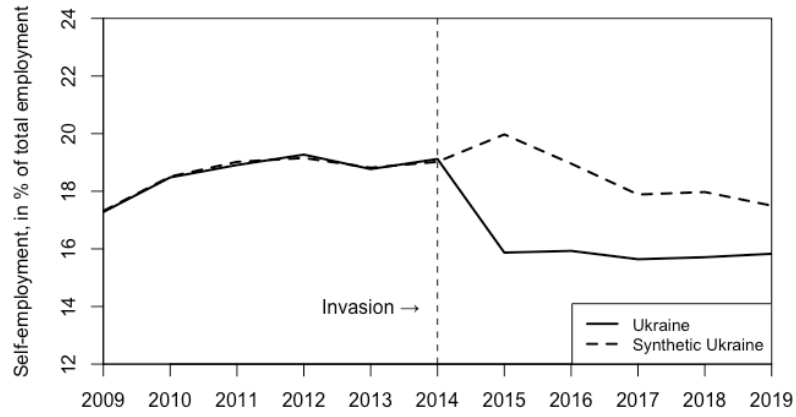

Panel b: SMEs

**Table 2: Country statistics and weights in Synthetic Ukraine and Russia**

	% Self-employed of totally employed				% SMEs of working-age population			
	Country mean	Country median	Synthetic Ukraine	Synthetic Russia	Country mean	Country median	Synthetic Ukraine	Synthetic Russia
Russia	7.28	7.18	excluded	-	3.51	3.53	excluded	-
Ukraine	17.35	17.28	-	excluded	1.58	1.57	-	excluded
Armenia	42.21	42.80	0.192	0.000	2.19	2.23	0.002	0.001
Australia	17.38	17.14	0.000	0.000	13.49	13.18	0.001	0.000
Austria	13.09	13.20	0.000	0.000	1.55	1.54	0.107	0.002
Azerbaijan	67.69	68.06	0.000	0.000	0.83	0.78	0.048	0.001
Belarus	4.12	4.06	0.000	0.595	0.85	0.88	0.003	0.001
Belgium	14.55	14.36	0.000	0.000	7.07	7.01	0.001	0.000
Bulgaria	12.10	12.11	0.000	0.000	2.44	2.57	0.072	0.200
Croatia	17.53	18.08	0.000	0.000	5.64	5.60	0.027	0.000
Cyprus	16.72	17.56	0.000	0.038	29.30	28.56	0.001	0.000
Czech Republic	17.41	17.34	0.013	0.000	5.18	5.08	0.004	0.000
Denmark	8.96	9.10	0.000	0.000	7.39	6.94	0.038	0.363
Estonia	9.14	9.11	0.374	0.000	16.46	16.03	0.000	0.000
Finland	13.53	13.44	0.000	0.000	6.87	6.91	0.001	0.000
France	11.41	11.54	0.000	0.000	4.66	4.56	0.001	0.000
Georgia	55.97	56.53	0.000	0.000	5.73	5.40	0.002	0.000
Germany	11.05	11.20	0.000	0.000	1.04	1.07	0.000	0.001
Hungary	11.42	11.28	0.000	0.000	5.55	5.79	0.003	0.001
Iceland	12.59	12.72	0.000	0.000	14.81	14.43	0.002	0.000
India	80.34	80.12	0.000	0.000	0.13	0.13	0.154	0.167
Ireland	16.56	16.81	0.000	0.000	6.21	6.02	0.001	0.000
Israel	11.97	11.99	0.000	0.000	6.53	6.54	0.007	0.001
Italy	24.51	24.82	0.000	0.000	3.66	3.58	0.003	0.001
Japan	11.62	11.53	0.000	0.234	0.09	0.07	0.001	0.025
Korea, Rep.	27.47	27.41	0.000	0.000	1.39	1.33	0.004	0.001
Lithuania	11.67	11.77	0.000	0.119	5.28	5.46	0.029	0.000
Mexico	32.71	32.92	0.000	0.000	0.77	0.67	0.000	0.005
Mongolia	52.51	50.72	0.000	0.000	4.54	4.65	0.002	0.000
Montenegro	18.99	18.85	0.000	0.000	6.95	6.86	0.004	0.000
North Macedonia	26.56	26.84	0.001	0.000	5.76	6.04	0.004	0.001
Norway	7.15	7.02	0.000	0.013	7.63	7.47	0.002	0.000
Peru	55.44	55.17	0.000	0.000	5.07	5.12	0.003	0.000
Poland	21.79	21.83	0.000	0.000	0.95	0.89	0.000	0.001
Portugal	20.60	21.54	0.000	0.000	8.89	8.84	0.003	0.000
Romania	30.83	32.58	0.000	0.000	7.14	6.98	0.003	0.000
Serbia	31.22	31.35	0.000	0.000	2.43	2.33	0.003	0.216
Singapore	31.22	14.65	0.000	0.000	2.43	6.02	0.001	0.000
Slovak Republic	15.33	15.46	0.000	0.000	5.35	5.66	0.003	0.000
Slovenia	16.05	16.24	0.416	0.000	4.56	4.65	0.001	0.000
Spain	16.99	16.94	0.000	0.000	7.37	7.33	0.002	0.000
Sweden	10.33	10.41	0.000	0.000	7.35	7.31	0.004	0.000
Switzerland	15.25	15.27	0.000	0.000	6.63	6.61	0.003	0.000
Tajikistan	36.86	37.29	0.000	0.000	0.36	0.41	0.445	0.003
United Kingdom	14.59	14.63	0.000	0.000	7.88	7.49	0.001	0.000
Uzbekistan	40.13	40.32	0.000	0.000	0.53	0.51	0.001	0.002

Figure 2: The conflict's effect on self-employment in Ukraine vs. Synthetic Ukraine

Panel a: Trends in self-employment for Ukraine vs. Synthetic Ukraine

Panel b: Self-employment gap for Ukraine vs. Synthetic Ukraine
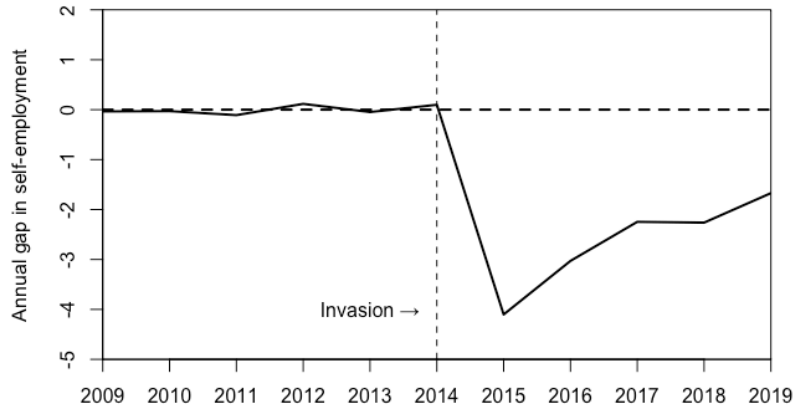
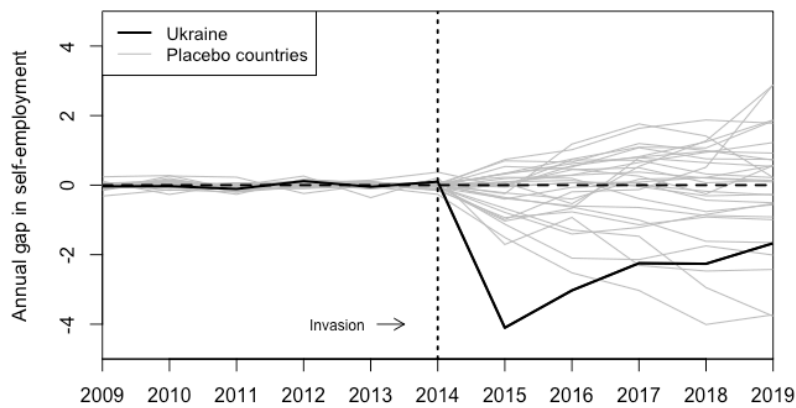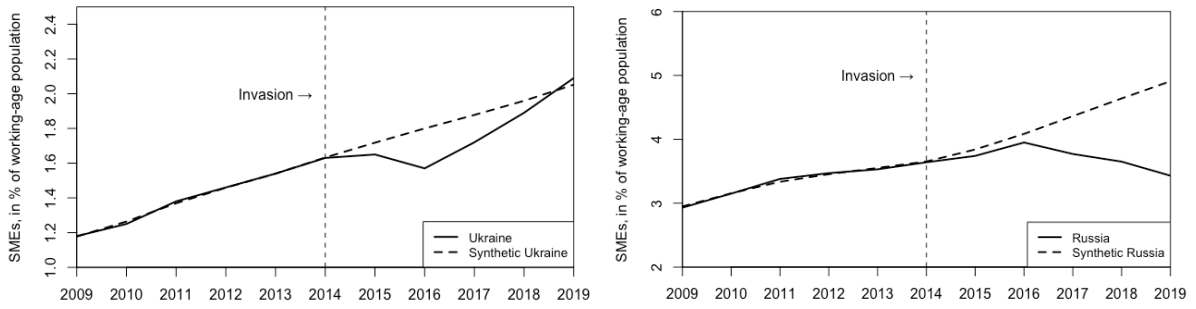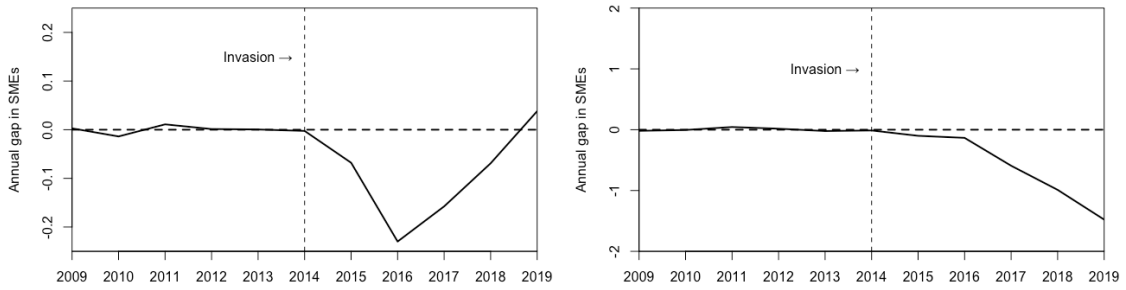**Panel c: Placebo tests for self-employment gaps in Ukraine and donor-pool countries**

Figure 3: The conflict's effect on SMEs in Ukraine and Russia vs. their synthetic versions

Panel a: Trends in SMEs

Panel b: SME gaps

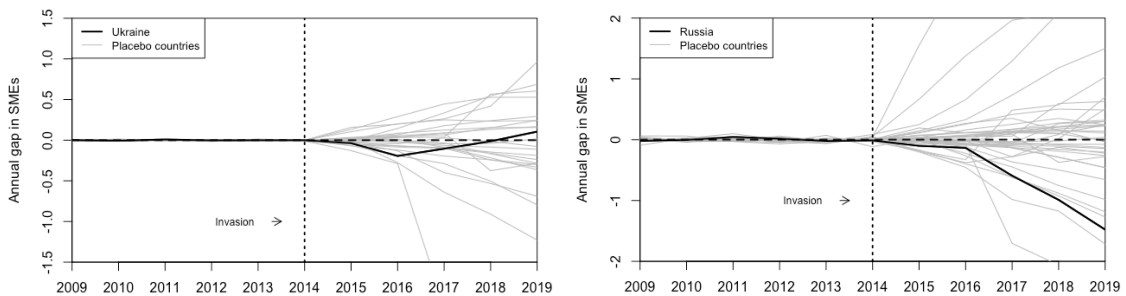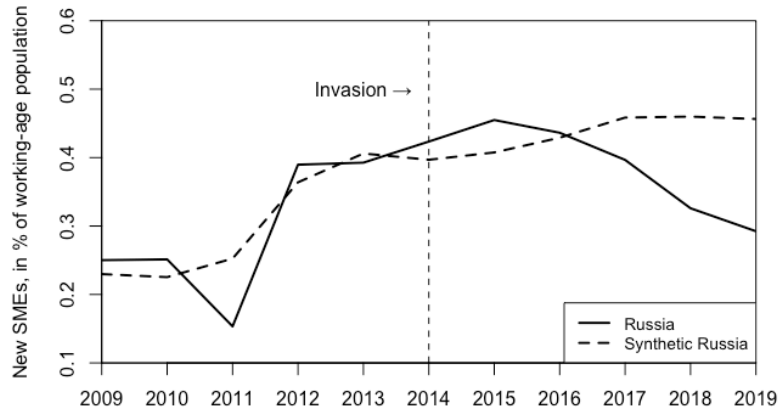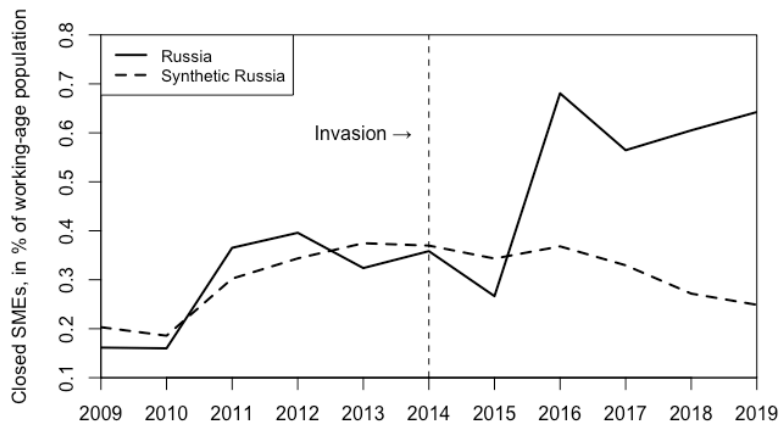**Panel c: Placebo tests for SME gaps and donor-pool countries**

Figure 4: Birth and death rates of SMEs in Russia vs. Synthetic Russia

Panel a: Trends in the SME birth rate

Panel b: Trends in the SME death rate

Appendix

Table A.1: Variable definitions, data sources, and summary statistics

Variable	Description	Data source	Mean	SD	Q1	Median	Q3	Pre-inv. mean	Post-in. mean	Δ in means
% Self-employed	Share of total employment, modeled ILO estimate. Self-employed are defined as workers whose remuneration is directly dependent upon profits derived from goods&services produced.	International Labor Organization	22.45	16.58	12.01	15.88	26.84	23.12	21.65	-1.47
% SMEs	Business density is defined as the total number of registered firms per 1.000 working-age people (those ages 15–64). The units of measurement are private, formal sector companies with limited liability.	World Bank, Entrepreneurship Database	5.68	5.19	1.69	5.41	7.01	5.12	6.30	1.18***
GDP per capita	GDP per capita is gross domestic product divided by mid-year population. Data are in current U.S. dollars.	World Bank, National accounts	26,509	22,699	6,988	18,656	43,647	26,336	26,717	381
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in U.S. dollars	World Bank, National Accounts data	2.30	3.84	0.99	2.43	4.10	1.75	2.96	1.20***
Foreign direct investment, net inflows	Foreign direct investment refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Data in current US$.	World Bank, International Monetary Fund	17,021	35,107	1,037	4,769	21,396	16,658	17,456	798
Starting a business - Score	The score for starting a business is the simple average of the scores for each of the component indicators: the procedures, time and cost for an entrepreneur to start and formally operate a business, as well as the paid-in minimum capital requirement.	World Bank, Doing Business project	86.85	7.91	83.10	89.00	91.90	84.92	89.17	4.25***
Domestic credit to private sector	Domestic credit to private sector, expressed as percentage of GDP. The measure refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.	World Bank, International Monetary Fund	70.60	49.63	44.98	65.10	115.70	84.02	76.50	-7.52*
Unemployment	Share of total employment, modeled ILO estimate. Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	International Labor Organization, ILOSTAT	8.79	5.51	5.10	7.01	10.70	9.38	8.10	-1.28***
Research and development expenditure	Gross domestic expenditures on R&D, expressed as a percent of GDP. They include both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit. R&D covers basic research, applied research, and experimental development.	World Bank, World Development Indicators (WDI)	1.44	1.13	0.49	1.18	2.19	1.42	1.47	0.04
Patent applications, residents	Patent applications are worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention.	World Bank, WDI	12,422	44,473	136	792	2,288	12,540	12,325	-215