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Article

Military conflicts and the performance of state-owned enterprises:
A study of Ukraine's aerospace, defense, and electro-engineering
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Military conflicts and the performance of state-owned enterprises: a study of Ukraine's aerospace, defense, and electro-engineering industries before and after the 2014 Crimea and Donbas occupation

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Abstract: This study addresses the under-researched role of state-owned-enterprises (SOEs) in global value chains/production networks (GVCs/GPNs). It examines how the economic performance, foreign trade, and value capture of Ukrainian firms – classified by ownership, position in GVCs/GPNs, size, and diversification of their customer base – have evolved following the Russia's occupation of Crimea and parts of Donbas in 2014. The study reveals significant differences in the distribution of SOEs, private, and foreign enterprises between the aerospace/defence and electro-engineering industries. Overall, since the Russian aggression in 2014, the aerospace and defence industries have outperformed electro-engineering firms, largely due to strong state support. The study concludes with broader observations that while even intensive mutual trade could not prevent the war, the war does not necessarily lead to a complete cessation of mutual trade.

Keywords: state-owned enterprises; global production networks; geopolitical decoupling; tier; economic performance and value capture

1 Introduction

State-owned enterprises (SOEs) are often considered less profitable and less efficient compared to private corporations. This claim is attributed to a large set of factors ranging from accountability issues, governance structure, and human resources management, to multiple or hybrid objectives of SOEs, which, in addition, tend to be poorly

defined and monitored (Lazzarini and Musacchio 2018). A number of studies investigated the changes in economic performance of SOEs after their privatization. According to a review of these studies, in the majority of cases, privatization leads to improved efficiency, profitability, and financial health for the privatised firms (Megginson and Netter 2001). This view aligned neatly with the Washington consensus insisting that macroeconomic stability, liberalisation and privatization form the core of economic success (Estrin et al. 2019).

However, while the Washington consensus began to lose traction approximately around the 1990s, some of its intellectual traits have been retained such as an (over) generalized view on the SOEs (Wade 2018). Estrin et al. (2019) conducted an extensive comparative study investigating labour productivity of SOEs with their private counterparts across 57 countries and revealed that the difference in labour productivity between SOEs and private firms is substantially influenced by the quality of the institutional system in specific countries. Overall, SOEs and private enterprises do not display significantly different levels of labour productivity, and when differences do arise, labour productivity is higher in SOEs (Estrin et al. 2019). The finding that the relation between labour productivity of SOEs and private enterprises depends on multiplicity of factors, especially on institutional system is important, and warns against excessive generalisations. Moreover, the distribution of SOEs is highly uneven across industries in individual countries and tends to be strong especially in industries deemed strategic and/or related to natural resource extraction (Shapiro et al. 2018).

In addition, an important gap in our understanding is the position and the role of SOEs in global value chains/global production networks (GVCs/GPNs).¹ This is surprising as emerging economies especially often exhibit substantial state ownership among their largest firms, and these firms have been increasingly engaged in the global

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¹ Although some differences between these streams can be identified, we claim that their core is similar. Therefore, to acknowledge the distinctive contribution but also the shared core of these theories, we use the GVC/GPN acronym to denote this vigorous research stream.

economy in recent decades (Kowalski et al. 2013). Jones and Zou (2017) even argued that the massive overseas expansion of Chinese SOEs is a core driver of China's rise to great-power status.

In this paper, we selected strategic Ukrainian industries for a case study due to the following reasons. First, Ukraine is an emerging economy where SOEs play a significant role. Second, while there is a considerable body of research exploring the economic performance of SOEs following their privatization (Megginson and Netter 2001), the number of studies examining the impact of military conflicts on firms' performance is limited. Moreover, these studies do not specifically compare SOEs with private firms (Petracco and Schweiger 2012). Therefore, an investigation into Ukrainian strategic industries can reveal the dynamics of economic performance between SOEs and private enterprises under challenging conditions following the Russian military aggression in 2014. Third, this case is particularly intriguing due to the exceptionally strong economic ties between the Ukrainian and Russian economies, even in the most strategic and sensitive industries, until 2014.

The paper is structured as follows: The next section develops the conceptual framework of the study, which is centered on SOEs as well as the notion of value capture. A brief outline of evolution of Ukrainian aerospace, defense, and electro-engineering industries follows. Subsequently, our methodological approach is explained. The empirical section then presents the main results of our analysis, and the final section summarizes the main contribution of this study and considers arenas for future research.

2 The role of SOEs in the economy and their position in global value chains/global production networks

2.1 Changing views on the role of SOEs in economic development

The role of SOEs in current economies is contested. While under the Washington Consensus, SOEs were often regarded as relicts of the past, today, they appear to play an important role in many countries and sectors, particularly those critical to national security or resilience. For example, the state-backed Japan Investment Corporation (JIC) recently acquired JSR, a globally important Japanese semiconductor chemical supplier (Kleinhans 2024). Given heightened global geopolitical tension (Bednarski et al. 2023; Blažek

and Lypianin 2024; Glückler and Wójcik 2023; Kalvelage and Tups 2024; Pavlínek 2024), which, *inter alia*, led to concern of the EU politicians about the limited control over predominately private manufacturers within the European defence industry, we can foresee a much more active role for governments (including those of the most advanced countries) in the economy. Accordingly, Aoyama et al. (2024) recently argued that the primary imperative in GVC/GPN orchestration has shifted from firm-centric cost-efficiency to diplomacy and resilience, as multilateral state alliances gain prominence in shaping production networks, especially in strategic industries. Moreover, forthcoming economic transformation, induced by grand societal challenges including a need to tackle climate change (and) to safeguard the sustainability of the global environmental system, will also require the states to take a much more active role in the economy and society (Mazzucato and Ryan-Collins 2022).

A substantial body of research has compared the economic performance of SOEs and private firms (Lazzarini and Musacchio 2018). The prevailing consensus from these studies is that SOEs often exhibit lower efficiency and profitability (Li and Xia 2008). Similarly, studies on the impact of privatization of SOEs conclude that state-ownership results in a deterioration of firm performance (Cosset et al. 2020; Megginson and Netter 2001). The underperformance of SOEs can be attributed to various factors including a lack of competitive pressure, absence of profit motive and accountability to shareholders, moral hazards associated with state guarantees, corruption, nepotism, and lifetime employment contracts for workers, which can reduce productivity (Le et al. 2023). However, some authors have noted a contradiction between the widespread perception of SOEs as underperforming entities and their pervasive presence across a broad range of industries across various economies, including those that are dynamically expanding or highly developed (Jones and Zou 2017; Lazzarini and Musacchio 2018; Li and Xia 2008). Moreover, study by Le et al. (2023) on Indian and Chinese SOEs has documented that SOEs tend to innovate more than private firms.

Indeed, the main rationale for the creation of a state-owned entity is rarely profit maximization. In economics and international business literature, there are two traditional explanations for the existence of SOEs. The first is resolution of market imperfections, and the second is political strategies of governments which may be driven by various reasons, such as boosting economic growth, increasing employment or engagement in industries deemed strategic (Cuervo-Cazurra et al. 2014; Babic 2021). Therefore, these entities often become privileged vehicles for government agendas (Bozec et al. 2002; Horner 2022). Thus, there are

numerous economic and non-economic reasons for state ownership, and SOEs can pursue important non-commercial priorities (Kowalski et al. 2013).

Another line of argumentation critiques the narrow conceptualization of SOEs performance solely in terms of efficiency and profitability in comparative studies, which disregards the broader social, political, or strategic objectives of SOEs which encompass additional costs (Bozec et al. 2002; Horner 2022). SOEs tend to have longer investment horizons compared to private firms, which are often pressured to prioritize short-term profit maximalization (Le et al. 2023), driven by the shareholder-value paradigm (Milberg 2008). Consequently, SOEs may be better positioned to undertake riskier long-term investments, such as major R&D ventures. This aligns with a strong commitment to developing innovative capabilities through direct government intervention in catching-up countries (Le et al. 2023). Nevertheless, SOEs performance is typically measured using the same metrics as private firms, emphasizing profitability and productivity, thus disregarding their distinct and often multiple mandates.

It follows then that studies on the economic performance of SOEs are unlikely to arrive at a general conclusion, and a substantial level of granular accounting for specific factors is needed. One might assume, for example, that in times of economic and/or political hardship, SOEs, due to their political, social, developmental, or strategic goals, might benefit from their privileged access to various forms of governmental support and, consequently, trends in the economic performance of state-owned and private firms may differ (Lazzarini and Musacchio 2018).

Indeed, several studies have investigated the specific advantages enjoyed by SOEs which might boost their performance such as direct subsidies, state guarantees and loans, preferential regulatory treatment – including a priority access to public tenders – and exemptions from antitrust provisions or bankruptcy rules (Le et al. 2023). Other advantages may be more intangible. Particularly in countries with weak institutional framework, where the protection of property rights may hinge on firm's status and even court rulings and enforcement are controlled by politicians who may favour firms with strong connection to state officials, SOEs might accrue significant benefits Li and Xia (2008).

On balance, SOEs are susceptible to specific factors that contribute to their inefficiency and underperformance. Li and Xia (2008) claimed that SOE managers often assume dual roles, acting not only as agents of the investors but also as state officials, which may lead the pursuit of over-ambitious or wasteful projects (Li and Xia 2008). In addition, it is important to acknowledge substantial heterogeneity

among SOEs in terms of their behaviour. For example, Jones and Zou (2017) documented cases where certain Chinese SOEs recklessly pursued profit while systematically violating Chinese regulations, resulting in major failures such as the termination of a large ongoing international projects.

Therefore, currently, one can observe controversy regarding the performance of SOEs in comparison to private firms. This controversy can primarily be attributed to two fundamental factors. Firstly, the sharp variation and ongoing evolution of the industrial, socioeconomic, and institutional contexts in which SOEs operate (Estrin et al. 2019). Secondly, research comparing the economic performance of SOEs with their private counterparts often overlooks the broader objectives of SOEs beyond the narrow focus on short-term profit.

2.2 Position and value capture of SOEs in global value chains/global production networks (GVCs/GPNs)

While the state sector has traditionally been an important element in many economies, whether emerging or the most advanced (Jones and Zou 2017; Kowalski et al. 2013), the involvement of SOEs in GVCs/GPNs and specifically their positioning within value chain hierarchies remains largely undocumented and thus represents a gap in our comprehension of global production (Horner and Alford 2019). This is unfortunate considering that SOEs operate in a number of key industries, such as mining, manufacturing, public utilities, and financial institutions (Cuervo-Cazurra et al. 2014; Horner and Alford 2019), and have progressively become more involved in international trade over the last few decades (Kowalski et al. 2013). For instance, three quarters of Chinese firms listed in the Fortune 500 were SOEs (Jones and Zou 2017). Likewise, Benito et al. (2016), based on an investigation of listed Norwegian firms, confirmed global ambitions of SOEs and their ability to benefit from internationalization due to government-related advantages. Babic (2021) argued that a handful of powerful states, motivated by a mix of profit, technology, and strategic control, are increasingly acquiring foreign firms, establishing state-owned subsidiaries abroad, and engaging in portfolio investments in global financial markets. This trend leads to a wide variety of ways for states to control and move enormous amounts of capital across the globe. This contrasts with a more traditional belief that SOEs are primarily oriented toward domestic markets (Cuervo-Cazurra et al. 2014; Kowalski et al. 2013).

Global value chains/global production networks are governed by lead firms that create, sustain, or reshape end

markets (Yeung and Coe 2015). Lead firms engage numerous suppliers that can be arranged into several tiers based on the level of production sophistication (Thoburn and Takashima 1992). Generally, higher-tier suppliers feature specialized assets and specific know-how, which makes them valuable partners for lead firms (Coe and Yeung 2015). Lower-tier suppliers often secure large-volume production while performing few functions of higher value added (Pavlínek and Ženka 2016). They rely predominately on generic assets and only rarely employ unique know-how (Coe and Yeung 2015), which makes them vulnerable as they can be replaced by yet cheaper suppliers (Bair and Werner 2011). Consequently, differing supplier capabilities and assets are likely to translate into value creation and, especially, the level of value capture (Pavlínek and Ženka 2016; Shin et al. 2012, 2017).

While any firm engaged in a GVC/GPN is a site of value creation – defined as the generation of an economic surplus over the costs of a given economic activity – it is the value capture that is the most important from a regional development perspective (Coe 2021). Value capture is defined as the ability of firms to retain surplus in their organizational boundaries within the power dynamics of production networks and, hence, is a dynamic rather than static attribute (Coe 2021). Nevertheless, the level of value capture is often seen as related to the position of a firm within the production hierarchy, which consequently translates into one of the key policy implications of the GVC/GPN approach, that is, to “move up the chain”, or to functionally upgrade (Pananond 2016). However, Coe (2021) argues that linear and deterministic pleas for functional upgrading disregard the wide range of shifting value capture trajectories, including downgrading dynamics.

Thus, there is no agreement in the literature about the nature of the relationship between the position of firms in value chains and their value capture, and even less so in relation to the ownership of enterprises (state versus private). This disagreement is attributable to a plethora of specific features in a firm, including ownership (state, private, foreign, or mixed), management skills and ambition, value chain (producer- or buyer-driven; quasi-hierarchical, modular, networked; expanding or retreating industry), and host region (leading, developed, left-behind, underdeveloped, etc.).

While the economic performance of firms can be primarily assessed through evolution of profitability and revenues, there is no consensus in the literature on measurement of value capture by individual enterprises (Pavlínek and Ženka 2016). We suggest that the indicator selection of value capture by individual firms should, first, reflect their

ability to develop and/or augment their assets as recommended by the resource-based theory of the firm (Wernerfelt 1984). Second, indicators of value capture should accrue the benefits by which the firm contributes to the host region (country) (Coe 2021). Thus, the value captured by firms can be structured according to several scales – firm, region, and country. Thus, we concur with Bowman and Ambrosini (2000) that value capture is a function of the resources/assets possessed by firms as well as of their external relationship with suppliers and customers as conceptualized by the GVC/GPN stream.

Consequently, based on this and existing research (Blažek and Holická 2022; Pavlínek and Ženka 2016) as well as reflecting the data availability, we will use the following indicators to measure value capture: personnel costs, depreciations, corporate taxes (all these indicators relativized to revenues), and average wages. These indicators (except corporate taxes) reflect the ability of enterprises to enhance their own assets, while corporate taxes indicate the contribution of firms in building regional (national) assets. Thus, corporate taxes represent value that is captured directly by the public administration in a given territory (state) and exemplify contributions that firms make to broader society.

Personnel costs capture firm investments in human resources. Inevitably, and especially, trained, skilled, and knowledgeable human resources easily move to other enterprises in the region (or beyond). Thus, investments by firms into their human resources can enhance – at least to a certain extent – a region’s human assets. Moreover, from a regional development perspective, it can be argued that a substantial share of personnel costs tends to be spent within the region, hence representing an important multiplier for the regional economy. To distinguish between firms that employ a large amount of low-paid labor and those that rely on a lower number of well-paid employees (in both cases the share of personnel expenditures on turnover can be high), this indicator will be combined with the average wage level. Finally, depreciations represent an indicator of capital and the technological intensity of production.

Therefore, this article aims to contribute to the literature by investigating how the economic performance and value capture of firms – classified by ownership and their position in GVCs/GPNs – have evolved due to abrupt worsening of the geopolitical and economic situation caused by Russia’s occupation of parts of Donbas and Crimea in 2014. Consequently, we would like to answer the following research questions. First, what are the primary differences in the distribution of state-owned, foreign, and private enterprises in the Ukrainian aerospace, defense, and electro-engineering industries within the hierarchy of

production networks? Second, what are the differences in revenues, profits value capture, and export and import among firms based on ownership (state-owned, foreign, private) and their position in GVCs/GPNs (lead firms, Tier 1, Tier 2, and Tier 3 suppliers), and how have these differences evolved across the periods 2010–13 and 2016–20?

3 Key features of Ukrainian aerospace, defense, and electro-engineering industries

Ukrainian aerospace, defense, and electro-engineering industries have been selected for examination for several reasons. Firstly, these industries are technologically related and have a distinct tradition in Ukraine, achieving international excellence in specific market segments. For example, in the late 1980s, the Kyiv-based firm Antonov developed and manufactured the world's largest cargo plane, the An-225 (Mriya). Secondly, given the current geopolitical situation, these industries play a vital role. Thirdly, they have been largely overlooked in the main research focus of GVC/GPN researchers.

Ukraine had become one of the key industrial centers of the Russian empire that specialized in labor-intensive heavy industries (coal and ore mining, metallurgy, mechanical engineering, etc.) during the Industrial Revolution. Throughout the Soviet period, which for Ukraine started in 1921 and lasted until the dissolution of the USSR in 1991, the Ukrainian economy was subjected to the principles of a command economy: firms were nationalized and foreign capital investments were banned (Matsevatyi 2009).

During the Cold War period, the Ukrainian aerospace and defence industries were fully integrated into the Soviet and Warsaw Pact production systems, which *a priori* excluded all direct contacts with Western GPNs. After the collapse of the Soviet Union, most production projects with Western countries or associated with global GPNs occurred within multilateral cooperation. For example, in the case of the first stage of Northrop Grumman's Antares rocket Ukraine provided the propellant tanks and plumbing (Harwood 2023).

The dissolution of the Soviet Union in 1991 resulted in economic malaise across the whole post-Soviet space, including Ukraine (Holovko 2003). The country's government pursued a policy of firm privatization; however, in contrast to other Eastern European countries, foreign investments were discouraged. Nevertheless, due to their strategic nature, most important firms in defense and aerospace remained under state ownership and were, in

2010, integrated into the state conglomerate Ukroboronprom (Dubrovskiy 2007).

After 1991, the firms in examined industries tended to pursue three major strategies. First, most firms continue to collaborate with others across post-soviet countries (Kyzym and Miliutin 2018; Romanukha 2014). Second, firms focus on repairing and upgrading products exported abroad before the dissolution of the Soviet Union (Shevtsov and Bondarchuk 2013). Third, some aerospace and electro-engineering firms reoriented their exports outside the former Soviet Union.

The Russian aggression in 2014 heavily affected the whole Ukrainian economy and led to displacement of 3.3 million people (Mykhnenko 2020). In August 2014, Ukraine imposed an embargo on the export and import of military and dual-use goods to and from Russia. Since then, Ukrainian firms have focused on finding alternative suppliers domestically and abroad, as well as securing new export markets in Europe and Asia (Blažek and Lypianin 2024; Ilchenko et al. 2021). Several higher-tier suppliers have downgraded their manufacturing activities, focusing on less sophisticated goods, especially in the production of final products. For instance, Antonov, Ukraine's leading aircraft manufacturer, was forced to cease final assembly of aircraft. In response, Antonov reoriented its operations toward the repair and modernization of older aircraft serving in various countries and also launched the production of unmanned aerial vehicles (UAVs). Similarly, Yuzhmash, Ukraine's foremost space rocket manufacturer, had to completely stop rocket assembly due to the loss of Russian customers for its flagship Zenith project. Many enterprises were compelled to reduce their production volumes and nearly ceased exports during the 2016–2020 period, as finding alternative export markets proved challenging – despite the existence of state-owned dedicated specialized traders – partly due to reliance on (post)-soviet technological platforms, most of which are incompatible with their Western counterparts. In 2022, the Ukrainian government established the Defense Procurement Agency to adopt NATO standards for transparency, reduce corruption risks, and address challenges in importing military hardware that arose with the existing specialized traders, who have predominantly focused on export transactions (Mereshchuk 2022).

The situation worsened substantially after Russia launched its full-scale invasion in February 2022. The persistent threat of cruise missiles and long-range loitering munition forced Ukrainian defense producers to disperse their operations across the country and even construct new factories underground (Rojas 2024). Domestic manufacturing

of military drones has expanded so rapidly that it now constitutes a distinct branch within Ukraine's defense industry (Balashova 2024). Aerial drones are now extensively used on the front lines for various purposes, including real-time tactical information gathering and artillery targeting, or even substituting for artillery altogether. The combination of missile strikes and remote-controlled drone boats laden with explosives has inflicted significant damage on Russia's Black Sea fleet, ultimately forcing its withdrawal from Crimea (Thorne 2024).

While Ukraine continued to export its defense production after the occupation of Crimea (Blažek and Lypianin 2024), the situation changed dramatically following the full-scale Russian invasion in February 2022. Since then, Ukraine has stopped the export of military products and has become the world's fourth-largest arms importer (Wezeman et al. 2024). The war also led to the establishment or intensification of cooperation especially with European defense enterprises. Major European manufacturers such as Rheinmetall, KNDS, BAE Systems, and others have expressed intentions to establish subsidiaries in Ukraine, primarily to ensure the repair and maintenance of previously supplied hardware. One notable example of this cooperation is the adaptation of the Soviet-era SU-24M tactical bomber to accommodate the Western Storm shadow/Scalp-EG air-launched cruise missiles developed by MBDA (Defense Express 2024).

4 Methodological approach

First, we created a database of firms in three selected industries. We utilized the services of the Ukrainian database provider YouControl² and identified the firms using the National Classification of Economic Activities codes 27.1, 27.2, 28.1, 30.3, 30.4, and 25.4. These correspond to the manufacture of electric motors, generators, transformers, batteries, general-purpose machinery, air and spacecraft machinery, military vehicles, weapons, and ammunition. Additionally, we examined the websites of related industrial associations as well as Ukrainian trade fair reports so as to also include firms manufacturing relevant products but classified under a different industrial code(s). This method allowed us to identify nearly a thousand firms. We then examined each one to verify their relevance to our study, excluding inactive, bankrupt, or insolvent firms as well as micro-enterprises with fewer than 10 employees. Firms located in occupied parts of Donbas and Crimea were excluded, reducing the list to 329 firms. Among these, we

selected 125 firms that had complete information about their economic performance during the investigated 2010–20 period in the YouControl database. We had to exclude 9 firms with unreliable values, such as zero expenditures on personnel costs. Then we collected data on ownership (state-owned, private, and foreign), key economic indicators including the number of employees, and export and import details categorized by individual countries. From the firms' web pages or annual reports, we excerpted data on the types of goods produced to determine their position in the production hierarchy and the level of diversification of their production. This information was not available for 11 enterprises, so our final set consists of 105 firms (Table 1). Given the relatively limited size of the final sample and the distinctions between firms in the aerospace/defense industries compared to electro-engineering enterprises, our analysis is primarily descriptive. We categorized these firms into lead firms and Tier 1, 2, and 3 suppliers using a methodology developed by Pavlínek and Janák (2007). Their methodology rests on assigning firms into tiers according to the most sophisticated product(s) they manufacture. To illustrate the way we assigned firms into tiers, Table 1 provides examples of products typical for particular tiers in each industry. We also classified five state-owned specialized traders that control most of the warfare and double-use products exports as a separate firm category.

Level of diversification was investigated to account for different power relationship between customers and suppliers beholden to one network and suppliers with more diversified customer base. In this exercise, we utilized experience gained during our previous research (Blažek and Lypianin 2022) and benefitted from the fact that enterprises tend to publicize the information about their key customers on their web pages to enhance their image (Ivarsson and Alvs-tam 2011). We classified enterprises into three categories: i) those serving predominately a single production network (low diversification), ii) firms supplying two networks, or one production network and the final market (medium diversification), and iii) firms serving three or more production networks (high diversification). We acknowledge that, even though the examination of web pages of individual enterprises is time-consuming, the above classification of enterprises can only be considered approximate.

Based on macroeconomic trends and the shifting geopolitical context, the following two periods were selected for our analysis. The first period, 2010–13, represents a short phase of relative prosperity and stability after the 2008–9 global financial crisis. The years 2014–15 represent a period of disarray caused by the Russian annexation of Crimea and the occupation of part of Donbas. Therefore, this period was excluded from our analysis. Consequently, the second

² <https://youcontrol.com.ua/en>.

Table 1: Typology of components used for classification of suppliers into tiers.

Category	Aerospace	Defense	Electro-engineering
Lead firms – assembly of end products	Airplanes, helicopters, drones, rocket launch systems, satellites	Tanks, infantry fighting vehicles, multiple launch rocket systems	Nuclear/classic steam supply systems, turbine halls, hydro/wind/cogeneration power plant equipment, photovoltaic modules, transmission, distribution grids
Tier 1 – design and production of devices/modules	Engines, fuselages, wings, chassis, dashboards	Engines, body frames, chassis, cannons	Reactors, turbines, generators, boilers, photovoltaic collectors, power transformers, energy storage
Tier 2 – production of module and sub-system components	Radars, navigation equipment, measuring devices, parts of engines, wings, and fuselages, seats, parts of galleys	Radars, navigation equipment, measuring devices	Pumps, coolant systems and control elements, fuel rods, automation equipment, burners, stators, rotors, blades, gearboxes, polysilicon wafers, distributors, high voltage towers, transformers, batteries
Tier 3 – production of relatively low value-added components	Various metal, plastic, and chemical components: distributors, cable bundles, current limiters, turbine paddles, valves, ventilation equipment, high-pressure vessels, gates, polysilicon, connection boxes, insulators, conductors, converters, circuit breakers, chokes, switchers, detectors, solar glass, tanks, metal parts and specialized armatures.		

Source: Adapted from Blažek and Lypianin (2024).

analyzed period covers the years 2016–20, when Ukrainian firms had to adapt to a new geopolitical situation caused by Russian aggression starting in 2014.

To investigate the level of value capture by individual firms and, subsequently, according to ownership and tier, all three indicators of value capture were relativized to revenues. In each firm, the share of personnel costs in revenues was adjusted by the level of average wages paid by a firm to account for differences in labour qualifications. Therefore, the value of personnel costs was multiplied by an index $P_i = W_i/W_a$.

W_i – average wage in a firm in a given period.

W_a – average wage in either aerospace/defense industries or in electro-engineering firms in a given period.

Then, the share of taxes to revenues was weighted by a factor of 3 (as paid taxes are directly captured by the state), the share of depreciations on revenues (reflecting the capital intensity of production) by a factor of 2, and the share of personnel costs remained with weight 1. Otherwise, without assigning weights, the level of value capture would be, to a decisive extent, determined by the share of personnel costs.

5 Empirical analysis results

5.1 Distribution of state-owned, private, and foreign firms within the production network hierarchy

In the empirical section, we first examine the distribution of SOEs within production networks, which remains

largely undocumented in the GVC/GPN literature (Horner and Alford 2019). We focus specifically on how the distribution patterns of state-owned, foreign, and private enterprises differ between the production networks of Ukrainian aerospace and defense industries on the one hand, and electro-engineering industry on the other. Overall, significant differences in the distribution of SOEs, private, and foreign enterprises have been observed according to multiple dimensions (Table 2). SOEs completely occupy the niches of specialized traders and dominate also among lead firms in aerospace/defense industries. In contrast, in the electro-engineering industry, private firms prevail in all tiers (except for a single lead firm which is state-owned) as well as among firms operating primarily outside GPNs. Notably, the presence of SOEs in the electro-engineering industry compared to aerospace and defense industries is minor, which reflects the strategic nature of the latter industries. Thus, our findings confirm the argument that SOEs tend to have a strong presence in economies, particularly in strategic industries, where they are also positioned at key nodes within production networks (Shapiro et al. 2018).

5.2 Shifts in economic performance and value capture of firms based on ownership, tier, and the level of diversification between the two periods

Next, we investigate the differences in revenues, profits, import, export, and value capture among firms based on

Table 2: Ukrainian state-owned and private enterprise distribution within the production hierarchy.

Industry	Ownership	Specialized traders	Lead firm	Tier 1	Tier 2	Tier 3	Outside GPN	Total
Aerospace and Defense	State	3	2	9	5	8	22	49
	Private	0	0	2	7	4	7	19
	Foreign	0	0	0	2	2	1	5
	Total	3	2	11	13	14	30	73
Electro-engineering	State	0	1	2	1	0	1	4
	Private	0	0	3	11	1	7	23
	Foreign	0	0	2	2		1	5
	Total	0	1	7	14	1	9	32
Total		3	3	18	27	13	39	105

Source: own.

ownership, their position in GVCs/GPNs, and how have these differences evolved across the periods 2010–13 and 2016–20.

As a consequence of the sudden major external shock caused by the 2014 Russian invasion, the decline in enterprise profits between the two periods was even steeper than the decline in revenues (Tables 3 and 4). The revenue decline was less severe for enterprises in aerospace and defense compared to electro-engineering firms (65.4 % versus 47.6 %). This difference reflects the strategic importance of the former industries and the resulting stronger state support for these firms. Accordingly, SOEs in the aerospace/defense industries performed relatively well, with their annual revenues decreasing ‘only’ to 69.9 %, surpassing both Ukrainian private and foreign enterprises, which suffered drops to 60.1 and 44.6 %, respectively. Moreover, SOEs in the aerospace and defense industries managed

to increase their average annual EBITDA to 129.5 % of the 2010-13 level, which is remarkable considering the decline in revenues. Revenues of lead firms and Tier 1 suppliers dropped significantly more than those of lower-tier suppliers, as they were more severely impacted by legal restrictions on trade in sensitive industries with Russia following the 2014 events, compared to lower-tier suppliers producing less specialized products for intermediate markets.

These findings highlight the markedly uneven level of public support across different ownership types and industries, with SOEs in the aerospace and defense industries receiving priority. Thus, while the prevailing consensus in the literature is that SOEs often exhibit lower efficiency and profitability (Li and Xia 2008), there are important specific cases that prove otherwise.

Table 3: Revenues, profits, export and import in aerospace and defense industries based on ownership in 2010–13 and 2016–20 periods (sum, mln. USD).

		Revenues		Profits		Export		Import		Number of firms	
		2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20
Tier	Spec. Traders	306.8	279.4	16.0	10.9	242.6	277.4	42.1	21.4	3	3
	Lead firm	421.1	254.0	27.1	29.8	64.8	45.9	122.3	17.4	2	2
	1.-tier	1,332.9	753.6	232.0	110.6	892.9	504.3	515.9	99.9	11	11
	2.-tier	192.2	193.9	12.2	17.2	71.5	377.3	18.3	5.3	13	13
	3.-tier	231.0	163.1	12.5	4.4	39.6	469.4	20.3	11.6	14	14
	Not involved	201.6	111.1	10.5	5.7	35.6	22.5	19.3	1.4	30	30
Ownership	State	1,589.5	1,111.6	77.3	100.1	605.6	368.8	342.2	59.4	49	49
	Private	999.8	600.6	233.3	77.7	692.5	484.0	379.5	94.3	19	19
	Foreign	96.4	42.9	−0.3	0.8	48.8	16.4	16.6	3.4	5	5
Level of diversification	Low	1,393.7	969.6	60.3	91.2	523.8	33.7	330.7	48.1	39	39
	Medium	1,220.3	741.8	248.8	86.3	788.3	835.5	402.8	106.0	26	26
	High	71.6	43.7	1.2	1.1	34.8	19.6	4.7	3.0	8	8
Size	Medium	99.7	61.6	8.3	2.7	50.3	14.5	6.5	11.6	22	25
	Large	2,585.9	1,693.5	302.0	175.8	1,296.6	22.6	731.7	145.4	51	48
Total		2,685.6	1755.1	310.3	178.5	1,346.9	869.2	738.2	157.0	73	73

*Source: authors’ calculation based on YouControl Database.

Table 4: Revenues, profits, export and import in electro-engineering industry based on ownership in 2010–13 and 2016–20 periods (sum, mln. USD).

		Revenues		Profits		Export		Import		Number of firms	
		2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20
Tier	Lead firm	160.6	85.1	52.0	27.0	89.3	35.9	36.0	12.1	1	1
	1.-tier	967.6	443.2	113.6	38.3	602.9	306.5	260.8	37.8	7	7
	2.-tier	145.9	81.4	8.0	5.4	63.1	33.6	19.5	7.5	14	14
	3.-tier	1.0	0.3	−0.2	0.0	0.4	0.1	0.0	0.0	1	1
	Not involved	29.3	10.5	0.7	0.4	4.5	0.1	3.1	0.3	9	9
Ownership	State	1,304.5	620.5	174.1	71.1	760.2	376.3	319.5	57.7	5	5
	Private	685.9	284.3	84.6	29.1	435.8	185.0	202.0	23.2	22	22
	Foreign	543.2	300.4	79.7	39.1	284.4	176.8	101.7	30.0	5	5
Level of diversification	Low	75.4	35.8	9.9	2.9	40.0	14.5	15.7	4.5	17	17
	Medium	295.1	146.2	64.8	32.2	131.8	52.6	61.0	18.8	9	9
	High	481.4	195.0	32.1	8.2	314.1	136.2	149.5	11.9	6	6
Size	Medium	528.0	279.3	77.3	30.7	314.3	187.5	108.9	27.0	15	19
	Large	80.4	42.1	4.8	3.7	12.9	5.3	9.2	2.4	17	13
Total		1,224.1	578.4	169.3	67.4	747.2	371.0	310.3	55.2	32	32

*Source: authors' calculation based on YouControl Database.

The break-up of traditional and strong ties with Russian enterprises following the 2014 Russian aggression led to dramatic changes in export, and especially in import figures. Like in case of revenues and profitability, the decline in both exports and imports was less severe in the strategic aerospace/defence industries compared to electro-engineering industry. In the aerospace and defence industries, lead firms of GVCs/GPNs and their highly specialized Tier 1 suppliers became much less dependent on imports than lower-tier suppliers, who significantly reoriented their production to serve Ukrainian final producers instead of seeking new export markets.

In contrast, the relatively smaller decline in exports highlights the critical importance for Ukrainian firms in both industries to search for alternative export markets to safeguard revenues and maintain their image and credibility as key exporters in specific segments. For example, between 2016–18, Ukraine fulfilled a major export contract for the 'Oplot' main battle tank with Thailand.

Even though numerous authors have argued that SOEs have progressively become more involved in international trade (Babic 2021; Benito et al. 2016; Jones and Zou 2017), our findings for the Ukrainian aerospace and defence industry support a more traditional view: SOEs, compared to private enterprises, are less engaged in both export and import activities (Cuervo-Cazurra et al. 2014; Kowalski et al. 2013). Similarly, in the electro-engineering industry, SOEs were relatively less engaged in both exports and imports compared to private enterprises before the events of 2014. However, while the relative decline in imports was similar between private firms and SOEs in the second period, the

decline in SOEs exports was less pronounced. As a result, SOEs achieved a higher export-to-revenue ratio compared to private firms. We attribute this finding to SOEs' preferential access to various forms of state export assistance.

Overall, across both industries and periods, SOEs captured less value in three out of four cases. The only exception was SOEs in the electro-engineering industry during the second period; however, their lead in value capture over private enterprises was minor (47.6 compared to 45.9). Although studies on value capture by individual enterprises based on their position in GVCs/GPNs exist (e.g., Blažek and Holická 2022; Pavlínek and Ženka 2016; Shin et al. 2012, 2017), to the best of our knowledge, they do not examine the differences in value capture between SOEs and private enterprises. Nevertheless, our findings align, first, with the broader mandates of SOEs, which extend beyond narrowly defined economic performance (Kowalski et al. 2013; Lazzarini and Musacchio 2018), and second, with the shift from firm-centric, cost-driven governance to resilience- and security-driven GVC/GPN governance in strategic industries (Aoyama et al. 2024).

In both industries, during the 2010–13 period, value capture followed a clear pattern based on the position of firms in production networks: as largely expected in the GVC/GPN literature (Pananond 2016), the highest level of value capture was found among lead firms, followed in descending order by Tier 1, Tier 2, and Tier 3 suppliers (with the exception of a single Tier 3 supplier in the electro-engineering industry). However, in the second period, due to the greater impact of legal restrictions on trade with Russia following the 2014 aggression, lead firms and Tier 1

Table 5: Value capture in aerospace and defense industries based on ownership in 2010–13 and 2016–20 periods (mean of standard score values of indicators).

		Taxes to revenues		Depreciations to revenues		Wages to revenues		Value capture		Number of firms	
		2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20
Tier	Spec. Traders	1.3	0.9	0.8	0.3	24.3	25.1	29.8	28.4	3	3
	Lead firm	4.2	2.3	9.7	5.0	37.5	26.5	69.2	43.5	2	2
	1.-tier	6.4	3.4	3.9	7.2	17.3	23.3	44.5	47.8	11	11
	2.-tier	2.4	1.9	2.3	2.5	19.8	27.9	31.6	38.5	13	13
	3.-tier	2.2	1.4	3.3	5.8	15.2	21.9	28.3	37.7	14	14
	Not involved	2.0	1.5	3.1	3.0	40.0	28.0	52.3	38.5	30	30
Ownership	State	2.4	1.5	4.3	3.9	21.5	25.6	37.3	38.1	49	49
	Private	8.2	4.0	4.0	6.6	15.3	17.2	48.1	42.3	19	19
	Foreign	0.7	1.3	5.0	4.4	16.3	14.3	28.5	27.1	5	5
Level of diversification	Low	2.3	1.5	4.5	3.7	22.2	24.3	38.2	36.1	39	39
	Medium	7.2	3.6	3.9	6.4	15.7	20.1	45.1	43.7	26	26
	High	1.3	1.5	4.4	3.6	17.2	19.6	29.8	31.4	8	8
Size	Medium	2.0	1.3	1.3	1.6	12.7	14.5	21.4	21.5	22	25
	Large	4.6	2.4	4.4	5.0	19.2	22.6	41.7	39.7	51	48
Total		4.5	2.4	4.2	4.8	19.0	22.2	41.0	39.0	73	73

*Source: authors' calculation based on YouControl Database.

Table 6: Value capture in electro-engineering industry based on ownership in 2010–13 and 2016–20 periods (mean of standard score values of indicators).

		Taxes to revenues		Depreciations to revenues		Wages to revenues		Value capture		Number of firms	
		2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20	2010–13	2016–20
Tier	Lead firm	8.0	6.1	2.3	15.2	18.3	21.6	46.8	70.2	1	1
	1.-tier	2.1	2.1	4.4	2.9	25.4	32.8	40.5	45.0	7	7
	2.-tier	2.6	1.6	3.8	2.9	13.5	16.8	29.0	27.4	14	14
	3.-tier	0.2	0.0	7.9	4.1	24.0	27.7	40.4	36.0	1	1
	Not involved	1.0	1.1	3.5	3.7	18.9	20.3	29.0	31.2	9	9
Ownership	State	3.3	2.8	2.1	6.4	21.7	26.4	35.7	47.6	5	5
	Private	2.2	2.5	4.4	3.1	24.4	32.2	39.9	45.9	22	22
	Foreign	3.2	2.0	19.7	2.4	16.6	17.1	65.5	28.0	5	5
Level of diversification	Low	5.3	4.3	6.5	9.7	15.7	18.7	44.6	51.0	17	17
	Medium	2.2	1.7	2.5	3.0	19.8	31.9	31.4	42.9	9	9
	High	2.0	2.3	4.1	3.0	29.5	31.6	43.9	44.7	6	6
Size	Medium	1.7	1.8	1.7	1.9	13.0	15.4	21.4	24.7	15	19
	Large	2.9	2.7	4.2	4.8	23.1	29.3	40.3	46.8	17	13
Total		2.9	2.6	4.0	4.6	18.1	22.8	34.8	39.8	32	32

*Source: authors' calculation based on YouControl Database.

suppliers, which manufacture final or highly specific products, were inevitably more affected than lower-tier suppliers. As a result, value capture did not follow a clear pattern in this period (Tables 5 and 6).

6 Conclusions

The role of SOEs in modern economies is a contested theme. Once regarded as relics of the past, SOEs now play

an important role in many countries and sectors, particularly in those critical to national security, resilience, and in the development of new technologies to mitigate climate change. Although government efforts to enhance national security and resilience by ensuring the domestic production of essential goods are often seen as misplaced, given the complexities and interdependencies within and across value chains (Aoyama et al. 2024; Lee and Gereffi 2021; Ting-Fang and Li 2022), the current period of a disarray provides little incentive for decision-makers to alter their

policy approach. On the contrary, unless a major change occurs in the global political system, geopolitical decoupling and recoupling (Blažek and Lypianin 2024) is likely to become more frequent and deeper in the coming years. Therefore, governments are likely to seek control, especially over lead firms producing essential goods. Given the increased responsibility of lead firms for their suppliers in terms of environmental upgrading and regulatory compliance (Ponte 2022), especially state-owned lead firms may offer governments a new means of influencing the operation of GVCs/GPNs along with more traditional regulatory and trade-policy frameworks (Babic 2021). Consequently, the varied abilities and capabilities of governments to steer the economy, including through direct ownership of strategic enterprises, will become a major mechanism of uneven development at the global level.

In this context, Ukraine represents a particularly interesting case. The Ukrainian economy, even after the economic reforms following its regained independence in August 1991, remained characterized by a large state sector. Ukrainian privatization program was sluggish and cumbersome reflecting weak institutional and policy framework. Additionally, the aerospace and defence industries were (with some exceptions) deliberately exempted from privatization due to their strategic importance.

Empirically, first, our study revealed significant differences in the distribution of SOEs, private, and foreign enterprises in production networks. SOEs entirely occupy the niches of specialized traders and also dominate among lead firms in aerospace and defense industries. The presence of SOEs in the electro-engineering industry compared to aerospace and defense industries is minor, reflecting the strategic nature of the latter. Consequently, SOEs engaged in production networks act not only as the producers and buyers but, importantly, also act – at least to some extent – as vehicles for governmental regulation of industry as exemplified by the existence of “specialized traders” on the one hand and the huge industrial conglomerate Ukroboronprom on the other. Therefore, since the role of the state extends beyond its regulatory and facilitator roles (Babic 2021; Horner and Alford 2019), the involvement of SOEs in production networks also surpasses their simple producer role.

Second, Russian aggression since 2014 inevitably led to stronger intervention by the Ukrainian government in the economy. Thus, in the second period, the aerospace and defence industries performed much better than electro-engineering firms due to vigorous state support. While SOEs in the aerospace and defence industries scored particularly well, the opposite was true for SOEs in electro-engineering

industry, which were outperformed by their private counterparts in both revenues and profitability. Although during the 2010–13 period, aerospace and defence SOEs captured less value than private firms (but more than foreign enterprises), in the 2016–20 period, the differences became much smaller, with SOEs being the only ownership category to see an increase in value capture. These findings highlight the markedly uneven level of support from the Ukrainian government, with SOEs in the aerospace and defense industries receiving priority under severe state-budget constraints. Thus, our research cautions against excessive generalizations, as the role and performance of SOEs can, and does, vary sharply from one industry and period to another.

Third, the abrupt geopolitical decoupling from Russian enterprises following the 2014 aggression led to a dramatic decline in exports, and especially in imports, in both industries. The relatively smaller decline in exports highlights the critical importance for Ukrainian firms in both industries to secure revenues and maintain their image as exporters. While in aerospace and defense industries no substantial differences were identified in the evolution of exports and imports based on ownership, a clear pattern emerged according to the position of enterprises within production networks. In particular, lead firms and Tier 1 suppliers maintained a much higher share of their previous export levels compared to lower-tier suppliers. Meanwhile, lower-tier suppliers reoriented their production to serve Ukrainian final producers instead of attempting to find new export markets.

Overall, Ukrainian governments and leadership have gained substantial experience and knowledge in steering the economy during the challenging times following the 2014 Russian aggression, and especially since the full-scale war launched in February 2022. Strong state ownership in the critical aerospace/defence industries proved beneficial. Equally beneficial was the ability of Ukrainian firms, across various ownership categories, to replace import from Russia with domestic suppliers. This demonstrates the high adaptability and resilience of the Ukrainian economy under extreme conditions.

This adaptability, flexibility, and innovativeness were fully leveraged after February 2022, when Ukraine, for example, was able to develop and produce a vast number of aerial and naval drones with various capabilities and functions, often powered by AI-driven software. Consequently, we can foresee that once the war is finally over, the Ukrainian government will likely utilize its experience and know-how to continue, if not expand, its engagement in the economy.

Our research also led us to an important geopolitical observation. First, our investigation shows that even very intensive and traditional mutual economic ties were not able to prevent the war. Second, it reveals that military conflicts and wars do not necessarily lead to a complete cessation of mutual trade. This observation was recently confirmed when, despite the full-scale war against Ukraine launched in February 2022, Russia still continues to pay Ukraine for the transport of Russian oil to several Eastern European countries via the Druzhba (*Friendship*) pipeline.

Finally, we need to emphasize that our empirical research covers a period before the full-fledged Russian war on Ukraine launched in February 2022. Despite this war, the majority of the investigated firms remain operational, with some even substantially expanding production, while those located near the frontlines have been the most affected. Looking ahead, it is essential for geopolitical actors to uphold international law and seek peaceful resolutions to conflicts.

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