



The Takeaway

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Productivity and “War Vulnerability”

How Warfare Creates Productivity Gaps between Service and Nonservice Firms

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In many parts of the world, warfare continues to threaten supply chains, worldwide production, and global stability. Economic production is critical for a nation (and those who rely on its exports) in peacetime, but may be even more important during war. While some industries are vulnerable and witness production losses during war, others increase their output. This article discusses how firms’ processes affect vulnerability while exploring the effects of civil war on productivity.

WAR AND SECTORAL RECOMPOSITION

In 1999, British economist Paul Collier coined the concept of “war-vulnerable” and “war-invulnerable” economic sectors.¹ Featuring Uganda’s 15-year civil war, Collier examined the country’s GDP (Gross Domestic Product) composition before and at the end of the civil war. He found that war-vulnerable



WHAT’S THE TAKEAWAY?

Operational efficiency affects firms’ vulnerability to warfare.

During warfare, manufacturing and other nonservice operations witness reductions in productivity, while public administration and other service operations feature productivity increases.

Supply chain collaboration may help war-vulnerable sectors reduce operational risk.

More research is needed to understand the link between civil war and economic performance.

sectors, including manufacturing and construction, declined their GDP participation by 18.5 percentage points from pre-war levels. In contrast, war-invulnerable sectors, including agriculture, increased their participation by 15.5 percentage points.

Table 1: Uganda's GDP Recomposition (constant prices)

Group	1971 (pre-war)	1986 (post-war)
War-vulnerable sectors	42.5%	24.0%
War-invulnerable sectors	20.5%	36.0%
Unassigned activities	37.0%	40.0%

Source: Table adapted from Collier (1999).

Collier's work provided intriguing evidence associating civil war with changes in production levels, motivating researchers to understand further the mechanisms driving economic changes during warfare.

Two questions remain a subject of discussion. First, what are the drivers of this sectoral recomposition? Does it occur because war-vulnerable sectors reduce production or because war-invulnerable ones increase their production levels?

Second, to what degree does civil war cause changes in the economy and how important are feedback effects? Changes in war may cause production changes; however, simultaneously, production changes may alter conflict intensity. War can reduce economic output by influencing, for instance, labor productivity, capital stocks, infrastructure, or access to international markets. However,

poor living conditions and economic downturn can incite conflict—this is what economists call the conflict trap cycle.²

This link between civil war and economic activity has been investigated in the last 20 years, primarily using country-level information. Some researchers have explored the factors driving conflicts. For example, Fearon and Laitin (2003)³ investigated the likelihood of civil war onset using data from 161 countries. They found that poverty, political instability, rough terrain, and large populations contribute to a country's risk of civil war. Others have investigated the effects of war on the economy. Using data from African countries between 1962 to 2009, Lukongo and Rezek (2018),⁴ found that war reduces agricultural productivity by 0.41% per year.

REVISITING THE CONCEPT OF WAR VULNERABILITY

In a recent study published in the journal of Production and Operations Management (Jola-Sanchez, 2022),⁵ I explore the impact of Colombia's civil war on service and non-service operations. Since 1964, guerrilla groups have battled for control of the country, leaving more than one million casualties and eight million displaced. The study examined nearly 50,000 firms from 2000 to 2015 in regions with multiple levels of conflict.

The work suggests that civil war causes shifts in productivity in the three years after a conflict episode. This effect, however, diverges across service and nonservice firms. While civil war can increase productivity by up to 12.68% in service firms, such as public administration and defense, it can decrease

productivity in manufacturing and other nonservice operations by up to 3.64% a year after a violent episode occurs. The firms with the highest productivity growth are in the finance, insurance, utilities, public administration, and defense sectors. In contrast, the industries with the most significant reductions in productivity include agriculture and mining, wholesale and retail, and manufacturing.

These results help refine Collier's notion of war-vulnerable and invulnerable sectors. From Collier's perspective, war-vulnerable industries decrease participation in the country's GDP, while war-invulnerable ones increase participation. However, this sectoral recomposition may occur for multiple reasons, including price changes, productivity shifts, or simply due to production destruction. The evidence shown in this brief suggests that "war vulnerability" may be explained because some firms are more productive in transforming inputs into outputs during civil war, while others are less productive. These results, however, do not disprove that war destroys production or alters prices; it shows that war affects firms from the inside via process transformations.

SERVICE AND NONSERVICE OPERATIONS

Thus, it is worth evaluating how firms' service and non-service processes differ during warfare. The study finds that at least two aspects help explain the observed productivity gaps. The first is the firm's working capital structure. Since attacks interrupt the availability of raw materials and intermediate goods, material- and capital-intensive

firms would aim to strengthen their operational buffers. However, larger stocks of capital and materials can expose firms to robberies and asset destruction, slowing down productivity. Instead of more physical goods, service firms have higher financial cushions, which facilitates supplier transactions, outsourcing, and the payment of financial obligations.

Second, the productivity gap may also be rooted in how service firms use customers' ideas, operational information, and security alerts for process improvement. Customers only provide significant inputs into the production process during service processes. During nonservice operations, customers' input is restricted to purchase decisions.⁶ The study shows that service firms use customers' input for know-how creation to improve how they transform inputs into outputs during warfare. From interviews with logistics service providers, managers mentioned using customers' inputs to adjust their operational strategy during conflict episodes. Some managers reported opening direct and constant communications lines with their clients: "[it] is part of our strategy to have very good allies, and many of them [clients] inform us and prevent us from potential disruptions; they sometimes know if there will be a roadblock or a strike...we earn their trust."⁷ Thanks to their process flexibility, service firms partner with their customers to improve operational performance.

CONCLUSIONS

The notion of "war vulnerability" has pushed researchers to find the causes and conse-

quences of civil war. This concept has helped us understand that warfare does not affect all industries in the same fashion. From the operations management stance, vulnerability has much to do with firms' processes and efficiency. The differences between service and nonservice operations may explain productivity gaps during warfare, which influence, in turn, production levels and sectoral recomposition.

Policymakers should help vulnerable sectors reduce their exposure to warfare risks such as asset destruction, supply chain disruptions, and production decline. One way to do so is by fostering knowledge spillovers across supply chains and promoting outsourcing of risky and unproductive business functions. War-vulnerable sectors can benefit from service providers' know-how and productivity gains when strengthening collaboration and information sharing across supply chains.

However, more research is needed to improve our understanding of firms' day-to-day operations in conflict zones. Moreover, future research is essential to understand the role of the public sector in lessening firms' operational risk and fostering the transmission of information and knowledge across supply chains.

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Notes:

¹ Collier, P. (1999). On the economic consequences of civil war. *Oxford Economic Papers*, 51(1), 168-183.

<https://doi.org/10.1093/oeq/51.1.168>

² Collier, P., Elliott, V.L., Hegre, H., Hoeffler, A., Reynal-Querol, M. & Sambanis, N. (2003). *Breaking the conflict trap: Civil war and development policy*. World Bank and Oxford University Press. <http://hdl.handle.net/10986/13938>

³ Fearon, J.D. & Laitin, D.D. (2003). Ethnicity, insurgency, and civil war. *American Political Science Review*, 97(1), 75-90. <https://doi.org/10.1017/S0003055403000534>

⁴ Lukongo, O. E., & Rezek, J. P. (2018). Investigating spatial dependence and spatial spillovers in African agricultural total factor productivity growth. *The American Economist*, 63(1), 41-58. <https://doi.org/10.1177/2F0569434516672769>

⁵ Jola-Sanchez, A.F. (2022). How does warfare affect firms' productivity? *Production and Operations Management*. <https://doi.org/10.1111/poms.13658>

⁶ Sampson, S.E. & Froehle, C.M. (2006). Foundations and implications of a proposed unified services theory. *Production and Operations Management*, 15(2), 329-43. <https://doi.org/10.1111/j.1937-5956.2006.tb00248.x>

⁷ Jola-Sanchez (2022), p. 19.

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