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ENGINEERING UKRAINE'S WIRTSCHAFTSWUNDER

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ABSTRACT

Engineering Ukraine's Wirtschaftswunder

As Ukraine emerges from the devastation of war, it faces a historic opportunity to engineer its own Wirtschaftswunder—a productivity-driven economic transformation akin to post-war West Germany. While investment-led growth may offer quick wins, it is efficiency, innovation, and institutional reform that will determine Ukraine's long-term economic trajectory. Drawing on rich micro-level firm data spanning 25 years, this paper uncovers deep structural distortions that have suppressed creative destruction and productivity in Ukraine. It finds that business dynamism is on the decline, alongside rising market concentration among incumbent businesses, including low productivity state owned enterprises. To inform priorities for reviving business dynamism, this study develops a model of creative destruction drawing on Acemoglu et al. (2018) and Akcigit et al. (2021). The quantitative assessment highlights that policies that discipline entrenched incumbents are the bedrock for reviving business dynamism and engineer Ukraine's Wirtschaftswunder. Policies targeting specific types of firms have limited efficacy when incumbents run wild.

JEL CLASSIFICATION: O11, O43, P26, E65

KEYWORDS: Economic growth, Productivity, Post-conflict recovery, Middle-income trap, Business dynamism, Ukraine economy, Wirtschaftswunder

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1 Ukrainian *Wirtschaftswunder*

Joseph Schumpeter motivated the central role of creative destruction in advancing economic prosperity in his book *Capitalism, Socialism, and Democracy* (Schumpeter, 1942). He wrote that economies benefit when entrepreneurs with talent and vision introduce new products and technologies, displacing old products and business models, and generating ever higher productivity and growth. However, incumbents often collude to preserve the status quo. In fact, the destruction of outdated arrangements, including companies, jobs, technologies, policies, and public institutions, is essential for an economy to advance investment and technological change (World Bank, 2024).

Over the past three decades, Schumpeterian Growth Theory has formalized Schumpeter's ideas to examine the macroeconomic structure of growth as well as business dynamics and the reallocation of resources between incumbents and entrants in an economy.¹ In this paper, we analyze the evolution of economic growth in Ukraine through the lens of Schumpeterian growth theory, leveraging recent diagnostic frameworks developed by Akcigit and Ates (2021, 2023). Our analysis provides the first comprehensive assessment of business dynamics in Ukraine over the first quarter of the twenty-first century, using firm-level registration and balance sheet data that span nearly the entire universe of Ukrainian enterprises. We complement these core data with detailed information on foreign direct investment flows and the full registry of state-owned enterprises, enabling a rich characterization of both private and public sector dynamics.

Our analysis reveals a troubling decline in business dynamism across Ukraine. In the early 2000s, particularly between 2002 and 2007, newly established Ukrainian firms exhibited vigorous “up or out” dynamics, closely mirroring the high-churn, high-growth pattern seen in the United States. However, between 2008 to 2013, business dynamics flat lined, resembling stagnation seen in Mexico. Business dynamics worsen after 2014, where the forces of creative destruction appear to have been choked. Young firms barely increased in size over a decade, a pattern strikingly similar to India's chronically sluggish business life cycle.²

Decline in Ukrainian business dynamism is undergirded by decline in the entry of new firms, inability of young firms to expand, as well as high and rising market concentration among the largest businesses. The four largest businesses in 4-digit manufacturing sectors accounted for approximately 53 percent of industry sales in 2019, up from 48–49 percent in early 2000s. The widespread presence of the State in contestable sectors exacerbates the challenges posed by market concentration. In manufacturing, State Owned Enterprises are overrepresented among

¹See Aghion and Howitt (1992), Aghion et al. (2014), and Akcigit and Kerr (2018) on macroeconomic growth structure, and Foster et al. (2006), Klette and Kortum (2004), Lentz and Mortensen (2008), and Acemoglu et al. (2018) on firm dynamics and reallocation.

²See Hsieh and Klenow (2014) and Akcigit et al. (2021) for more details.

low productivity firms and account for a significant share of sales in manufacturing industries.

More specifically, we find:

1. *After modest gains through 2008, the Ukrainian economy has stagnated over the subsequent decade.*
2. *Productivity growth, both total factor and labor, has been stagnant throughout the period.*
3. *Firm dynamism and selection have weakened sharply: early “up-or-out” patterns gave way to stagnation, with small firms increasingly surviving and creative destruction stalling over time.*
4. *The allocation of resources has become less efficient, as the correlation between firm size and productivity has declined.*
5. *The link between firm-level productivity gains and employment growth has weakened, reducing the responsiveness of job creation to rising efficiency.*
6. *New entrepreneurial activity has declined after 2008.*
7. *The contribution of young firms, key drivers of Schumpeterian dynamism, has declined markedly over time.*
8. *Market concentration has risen, with fewer firms capturing a growing share of economic activity, reflecting a decline in competitive pressure.*
9. *Despite having lower productivity, SOEs have gained market share over time.*
10. *FDI originating from tax havens is associated with sharply lower business entry rates.*

A key strength of our analysis is its reliance on a broad array of empirical moments, rather than a single indicator, to assess the trajectory of business dynamism in Ukraine. Dynamism is inherently multidimensional, encompassing firm entry, growth, exit, selection, market concentration, and the responsiveness of employment to productivity shocks. By jointly examining multiple, independent moments, we construct a more robust and credible diagnosis of long-run trends.³ The fact that all indicators point to a deterioration in firm dynamics, across time and firm cohorts, underscores the depth and persistence of the slowdown.

We identify two distinct breakpoints in Ukraine’s firm dynamics, around 2008 and 2014, marked by significant shifts in business dynamism patterns.⁴ Extensive robustness checks confirm that these patterns are not artifacts of data measurement or coverage, but instead reflect genuine structural changes in the economy.⁵ The timing of the break points in the data suggests

³Focusing narrowly on one metric risks conflating real structural change with measurement error, definitional inconsistencies, or data limitations.

⁴The first breakpoint coincides with the 2008 global financial crisis, which curtailed credit and export demand, while the second follows the 2014 Maidan protests and annexation of Crimea, triggering severe institutional and geopolitical upheaval.

⁵For robustness checks, see Section 5.

a potential link to macroeconomic shocks and the government's response to them, including policy interventions that may have inadvertently reinforced incumbent advantages, dampened competitive pressures, or distorted firm incentives.

Rather than catalyzing economic renewal, past practices appear to have entrenched inefficiencies and stalled Ukraine's transformation. Strong forces of preservation are holding back creative destruction and dampening the growth prospects of the Ukrainian economy. Politically connected firms, in particular, can exacerbate this stagnation by undermining market competition and impeding the reallocation of resources toward more productive enterprises (Akcigit et al., 2023b). In aggregate terms, the Ukrainian economy has experienced long-term stagnation relative to the United States. Since the late 1980s, Ukraine's per capita GDP has remained less than one-tenth that of the U.S. (Figure 1). When compared to South Korea, a well-known growth miracle, or to Poland, its neighbor and fellow post-communist transition country, Ukraine's economic performance appears markedly weak. Although Ukraine experienced a brief period of strong growth between 2000 and 2008, coinciding with improved business dynamics, subsequent years have been marked by volatility and divergence. Consequently, the country's economic output has effectively regressed to levels seen in the late 1980s.

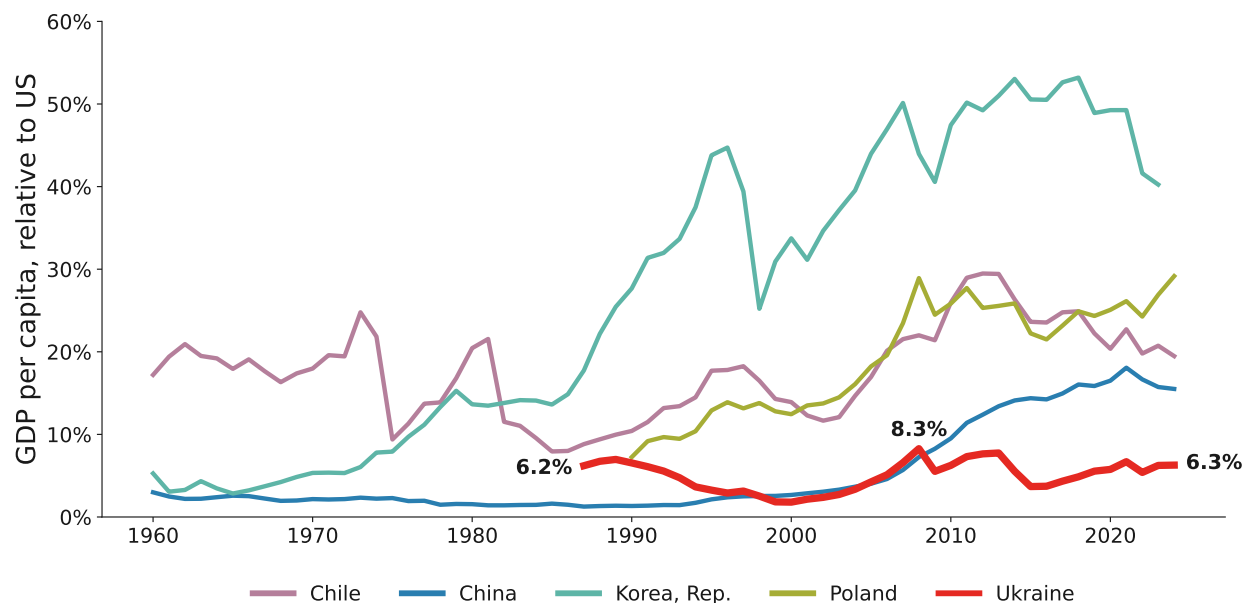


Figure 1: Anemic economic progress in Ukraine, leaving it at less than one-tenth of U.S. per capita GDP

Data source: World Development Indicators, World Bank.

Notes: The figure displays the GDP per capita (current US\$) of select countries relative to that of the United States over time. The data for Ukraine starts from 1987, and are plotted by the red line. The values 6.2%, 8.3% and 6.3% shows the relative GDP per capita of Ukraine in years 1987, 2008, and 2024, respectively.

For convergence toward European or American levels of economic output, future policies and investments will need to actively promote the forces of *creation*, allowing productive, value-adding firms to grow, as well as the forces of *destruction*, phasing out entrenched, unproductive businesses. The current crisis offers a rare opportunity to dismantle the legacy economic arrangements that have long hobbled the Ukrainian economy. In fact, Schumpeterian Growth Theory highlights that crises are a necessary evil as they weaken the forces of preservation that maintain the status quo.

What course should Ukraine's economy pursue in the years ahead? Should the country aim to restore the pre-war economic model, a path that may appear to be the most immediate and practical, or should it seize the opportunity to pursue a new road-map that could set it on a fundamentally different trajectory? To inform policy choices, we advance an analytic framework drawing on Klette and Kortum (2004), Acemoglu et al. (2018), and Akcigit et al. (2021) where incumbent (entrenched) firms and new entrants engage in innovation and production, and policy reforms aid in replacing existing products and firms by new, more productive ones. The framework allows us to examine the likely efficacy of policy choices and sequencing on individual business performance as well as aggregate technological change and economic growth.

Our simulations show that policies that discipline (entrenched) incumbents are the bedrock for heralding meaningful productivity growth. In the absence of such policies, others that support small or young enterprises through financial and regulatory support have limited impacts of resuscitating business dynamism. As many market leaders will have an important role in capitalizing the post war economy and diffusing modern technologies, policies will need to discipline, not vilify, these businesses.

The west German economy's *Wirtschaftswunder*, referring to the swift and dramatic improvement in its economy between 1948 and the 1960s is often attributed to technology transfer from the United States along with currency reforms and getting rid of price controls. However, through the Marshall Plan, the United States also sought to introduce domestic competition to Europe's highly cartelized industries (Kedrosky and Mokyr, 2025). The dismantling of IG Farben, Germany's massive chemicals conglomerate, by the allies in 1952, decreased industry concentration and increased patenting activity (Pöge, 2022).

Ukraine now stands at a critical crossroads, facing a pivotal choice about the direction of its economic future. The key question is whether Ukraine can embark on the more demanding, but ultimately more rewarding, path of building its own *Wirtschaftswunder* by fostering productivity, competition, and innovation.

Main Contributions

This paper speaks to several strands of research on growth, firm dynamics, and political economy. We first relate to the canonical body of *Schumpeterian growth theory*. Building on the seminal work of Aghion and Howitt (1992) and Grossman and Helpman (1991), subsequent contributions have incorporated richer firm-level heterogeneity and endogenous entry, including Klette and Kortum (2004), Lentz and Mortensen (2008), Acemoglu et al. (2018), and Akcigit and Kerr (2018). These papers formalize Joseph Schumpeter’s insight that long-run growth is powered by a process of continual creative destruction in which successful innovators displace incumbents. Our framework extends this tradition by embedding institutional capture, an empirically salient feature of many transition economies, into an otherwise standard Schumpeterian environment.

A second strand concerns the role of *business dynamism and resource reallocation* in driving aggregate productivity. Micro-macro decompositions for the United States show that most productivity growth stems from the reallocation of output and inputs toward more efficient producers (Foster et al., 2001, 2006; Haltiwanger et al., 2013). Cross-country comparisons reveal that misallocation and barriers to reallocation explain a sizable share of the productivity gap between rich and poor economies (Hsieh and Klenow, 2009; Syverson, 2011; Restuccia and Rogerson, 2013). Our empirical diagnostics follow the unified framework proposed by Akcigit and Ates (2021, 2023), which measure the life-cycle growth of firms, entry and exit dynamics, and the evolution of market concentration. We document a sharp post-2008 decline in Ukrainian business dynamism and show, both empirically and in our structural model, that rising institutional entrenchment is a key driver of this deterioration.

Third, we contribute to the growing literature on *political connections, state capture, and misallocation*. Early studies such as Frye and Shleifer (1997) and Faccio (2006) demonstrate that politically connected firms receive preferential treatment yet underperform on productivity and innovation. Closest to our mechanism is Akcigit et al. (2023b), who show for Italy that politically connected firms slow the pace of business dynamism. In a similar spirit, we quantify how Ukraine’s entrenched firms, often linked to the state or embedded in informal patronage networks, impair innovation incentives and resource allocation.

Our study also intersects with research on *state-owned enterprises (SOEs) and market concentration*. Evidence from many emerging markets suggests that SOEs are frequently less productive and crowd out private investment (Hallward-Driemeier and Pritchett, 2015; World Bank, 2023). More recently, Brandt et al. (2025) highlight the role of SOEs as de facto entry barriers, distorting competition and resource allocation. In parallel, research on advanced economies documents a secular rise in market concentration and its adverse implications for innovation and dynamism, driven by the emergence of “superstar” firms (Autor et al., 2020; Decker et al., 2016; Akcigit and Ates, 2023). We document a comparable increase in concentration in Ukraine’s manufac-

turing sector, but trace its origins to political entrenchment and state ownership rather than to technological scale economies alone.

Finally, our paper contributes to the growing firm-level literature on the Ukrainian economy. Using longitudinal data on initially state-owned manufacturers, Brown et al. (2006) find that privatization raised total factor productivity by 15 percent in Romania and 8 percent in Hungary, but only 2 percent in Ukraine and -3 percent in Russia. Earle et al. (2022) document that over two-thirds of oligarch-controlled firms employ defensive ownership structures, such as proxies, shell companies, or offshore vehicles, to shield assets, with this practice becoming significantly more common among formerly regime-connected firms after the political turnover. Balabushko et al. (2018) document that politically connected firms in Ukraine are larger and employ more workers, but are less productive and grow more slowly in both sales and employment than their unconnected counterparts, highlighting the allocative inefficiencies and productivity costs associated with political capture. Exploiting census-type panel data on over 7,000 manufacturing enterprises, Earle and Gehlbach (2015) show that, in the three years following the 2004 Orange Revolution, firm productivity rose by more than 15 percentage points in the most pro-Yushchenko regions relative to the most anti-Yushchenko regions. More recently, Avdeenko et al. (2024) examine the private sector's response to Russia's invasion of Ukraine in 2022, documenting widespread economic disruption and emerging adaptation strategies. Becker et al. (2025) emphasizes that Ukraine's reconstruction will be a long-term process involving not only the restoration of physical infrastructure and productive capacity, but also institutional modernization.

Taken together, the present paper contributes by (i) providing the first economy-wide measurement of Ukrainian business dynamism using near-universe administrative data; (ii) embedding institutional capture into a Schumpeterian model calibrated to those data; and (iii) quantifying how anti-capture reforms complement, and in many cases dominate, standard pro-innovation policies in restoring growth.

The remainder of the paper is organized as follows. Section 2 documents the evolution of business dynamism in Ukraine, focusing on firm life cycles, market concentration, entry patterns, the growth of young firms, and the responsiveness of firms to productivity shocks. Section 3 presents our analytical framework of creative destruction and institutional capture. Section 4 uses this framework to conduct a quantitative analysis and evaluate two sets of policy counterfactuals. Section 5 discusses the robustness of our results. The final section concludes. The Appendix provides additional data details and further robustness checks.

2 Business Dynamism

2.1 Data

We use administrative firm level micro data for nearly every single firm registered in Ukraine over the last two decades. The main source of these data are financial reports that Ukrainian enterprises annually submit to the State Statistics Service of Ukraine and the State Tax Service of Ukraine. These data cover nearly the universe of Ukrainian firms from 2002 through 2024 and includes information on registration address, region, 4-digit industry classification, employees, capital, and sales. From 2002 to 2019, data were collected from private market aggregators, offering extensive coverage. During this period, the data encompasses nearly 100 percent of employment in Ukraine and between 90 percent and 100 percent of firms operating in the country (see Appendix Tables A1 and A2). For the years 2020 to 2024, data were obtained from the official Open Data Portal of the State Statistics Services of Ukraine. While the data from 2022 to 2024 covers nearly 100 percent of employment and firms in Ukraine, the coverage for 2020 and 2021 is less comprehensive, capturing only 60-70 percent of firms and 50-70 percent of employment. This discrepancy is partly due to the Ukrainian government's relaxation of financial reporting requirements for firms during the COVID restrictions. We combine financial statements data with PPI data at the 2-digit NACE industry level to convert nominal sales into real sales.

Firm dynamics studies often focus on manufacturing not only because of better data and more measurable outputs, but also to ensure comparability with a well-established body of research. Following this approach, we focus on manufacturing, the largest segment of the Ukrainian economy.

We add to the financial reports data (FRD) by linking information from the Single Registry of Legal Entities of Ukraine. This registry provides detailed data on every firm registered in Ukraine, including their registration dates. By utilizing these registration dates, we determine the age of each firm. We also make use of firm level foreign direct investment (FDI) data from 2000 to 2013 that includes a list of firms receiving FDI each year, along with information on the source country of the FDI. These data are derived from the quarterly 10-zez form titled "On foreign direct investment in Ukraine." The quarterly FDI data provide details on the stock and flow of FDI by the country where the investment originates as well as the currency of the transaction. A firm is classified as foreign in a given year if it has a positive FDI stock at the end of the last quarter of that year.

We also make use of a comprehensive list of state-owned enterprises, sourced from the State Property Fund of Ukraine. This list has been systematically compiled since January 2008. The most recent version covers the period from 2008 to 2023 and includes enterprises where the state holds more than a 50 percent ownership share. Over this time frame, the number of state-owned

enterprises has gradually declined from 4,604 in 2008 to 3,260 in 2023.

2.2 Inefficiency

A lesson that emerges from economic growth assessments across countries is that efficiency improvements that accompany investment accelerations are critical for rapid economic progress (World Bank, 2024). In fact, episodes of growth accelerations typically include a combination of investment and efficiency growth, with efficiency measured as total factor productivity (TFP). In Korea’s case, its rapid rise in incomes per capita from 15 percent of U.S levels to 35 percent over ten years in the 1980s was accompanied by steady TFP growth (Figure 2). In contrast, the TFP growth in Ukraine has been declining since 2013, along with its economic progress.

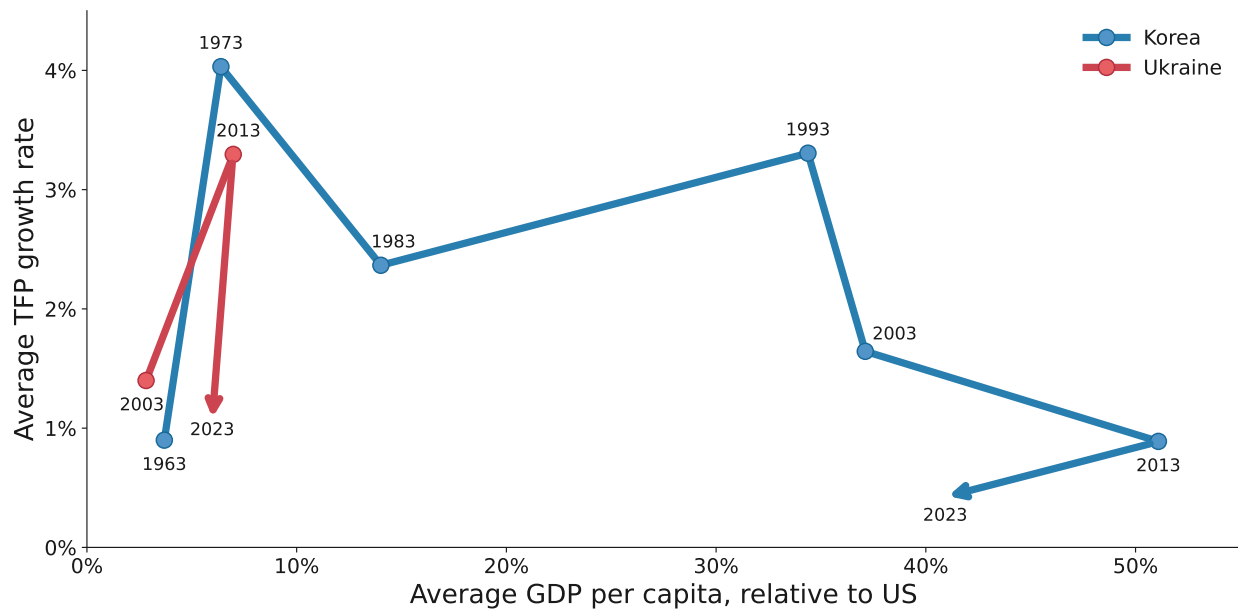


Figure 2: Rapid economic progress needs steady improvements in efficiency - Korea succeeds while Ukraine falters

Data source: Penn World Table 10.01 and World Development Indicators, World Bank.

Notes: The figure shows the relationship between the average growth rate of aggregate TFP in a decade and the GDP per capita (current US\$) of the country relative to the US at the end of that decade. For any year t , average TFP growth between years $t - 10$ and $t - 1$ are plotted on the vertical axis, and average relative GDP per capita between years $t - 1$, t and $t + 1$ are plotted on the horizontal axis. Aggregate TFP growth is calculated from the Penn World Table 10.01.

A clearer view of inefficiency is seen in the performance of Ukrainian businesses. Labor productivity growth in manufacturing averaged 15.2 percent between 2002 and 2013 but dropped sharply to 3.7 percent between 2014 and 2019 (Figure 3).

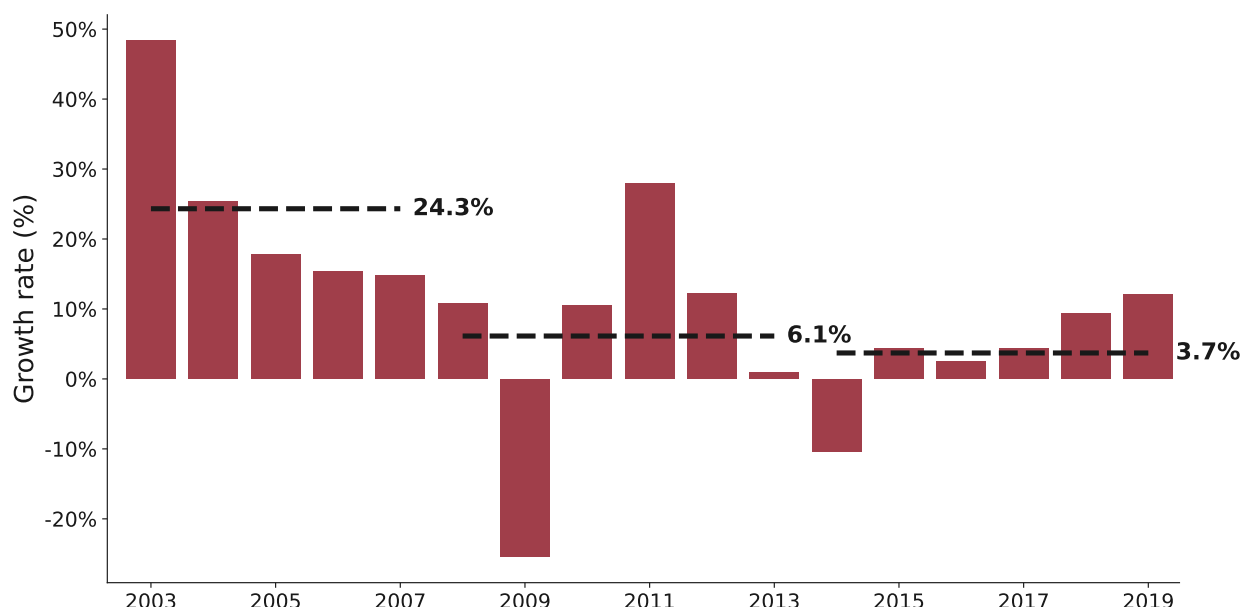


Figure 3: Ukraine's productivity growth has visibly lost steam

Notes: The figure plots the annual growth rate of aggregate labor productivity of the manufacturing sector. Firm level labor productivity equals real sales divided by employment, where nominal sales of the firm is deflated by the 2-digit sector producer price index. Aggregate log labor productivity of a year $\times$ 4-digit sector pair is calculated as the weighted average of firm-level log labor productivities belonging to the cell, weights being firm's employment share in the cell. Then, we take weighted average of 4-digit sector aggregate log labor productivities across sectors in a year, weights being sector's employment share in the year. Aggregate labor productivity in a year equals the exponential of aggregate log labor productivity. Annual growth rate in year t is calculated as the percentage growth of aggregate labor productivity from year $t - 1$ to year t . Horizontal dashed black lines show average growth rates in three periods: 2002–2007, 2008–2013, and 2014–2019.

2.3 "Flat and Stay": The State of Ukrainian Business Dynamism

The term “up or out” describes business dynamics in efficient economies. In the United States, a celebrated feature of the economy is the selectivity of its markets (Haltiwanger et al., 2013; Hsieh and Klenow, 2014). Start-ups and young businesses face pressure to move “up” or “out” – entrants exit at disproportionately high rates, but those that survive tend to grow quickly. The most successful firms mature and grow larger, displacing less productive firms. Expanding businesses invest in managerial and technical capabilities as well as R&D required to raise efficiency and product quality. In fact, the average young American firm grows by a factor of 7 by age 40, assuming it manages to stay in business. Entrepreneurs who are failing either move out to start newer ventures or find jobs in flourishing businesses. Efficiently allocating resources towards high-productivity businesses not only helps the businesses themselves but also boosts job and output growth and create positive spillovers for other businesses along the value chain.

However, in many emerging economies, business dynamics are characterized by the term

“flat and stay” (World Bank, 2024). The growth rates of firms in India, Mexico, and Peru are far lower than those of firms in the United States, with firms expanding by less than a factor of 3. Conversely, when firms with growth potential lack dynamism, they fall short of displacing unproductive firms from the market (Akcigit et al., 2021). Such flat and stay dynamics reduce wages and wage-earning opportunities and discourage businesses from infusing global technologies and innovating.

Our analysis of firm-level data reveals a troubling decline in business dynamism across Ukraine. In the early 2000s, particularly between 2002 and 2007, newly established Ukrainian firms exhibited vigorous “up or out” dynamics, closely mirroring the high-churn, high-growth patterns seen in the United States. Benefiting from the momentum of post-Soviet market liberalization, surviving firms not only endured competition but expanded even more rapidly than their American counterparts (Figure 4).

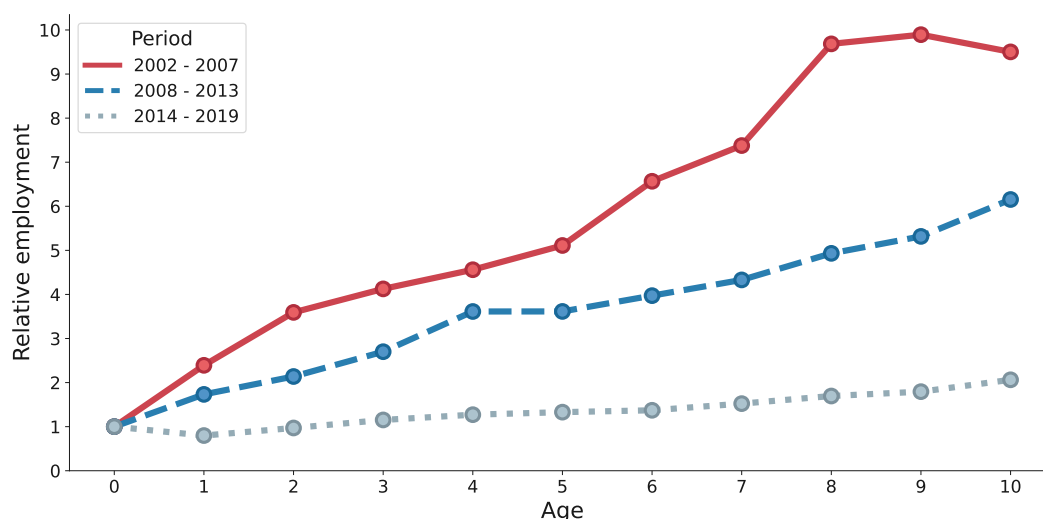


Figure 4: Faltering business dynamics in Ukraine: From resembling the United States to following Mexico and landing on India’s business dynamics

Notes: The figure plots the firm life cycle profiles in each period; 2002–2007, 2008–2013, and 2014–2019. Relative employment of a period $\times$ age bin equals the ratio of average employment of firms belonging to the bin to the average employment of zero-year old cohorts in the same period.

That early promise, however, has faded. From 2008 to 2013, firm dynamics began to flatten, echoing the stagnation typical of Mexico’s business environment. Rather than scaling up or exiting, firms increasingly hovered in a state of low growth and low productivity — what might be called a “flat and stay” equilibrium. The picture darkens further in the post-2014 period. Between 2014 and 2019, the forces of creative destruction appear to have stalled entirely. New firms barely doubled in size over a full decade, a pattern strikingly similar to India’s chronically

sluggish firm life cycle.

A high persistence of small firms within a cohort's life cycle can be indicative of deeper structural issues in an economy. In well-functioning markets, firm size distributions evolve through a process of selection, where less productive firms exit and more capable firms grow. However, as Akcigit et al. (2021) argue, many developing economies exhibit a breakdown in this mechanism. The abundance of small firms is not merely a reflection of constraints they face, such as poor access to finance or weak managerial capacity, but instead signals a broader lack of competition. In particular, when high-potential firms have limited incentives to expand, perhaps due to institutional frictions or the dominance of incumbents, subsistence-level firms are allowed to survive longer than they should. As a result, the glut of small firms could be symptomatic not of entrepreneurial vitality but of insufficient reallocation and weak market discipline.

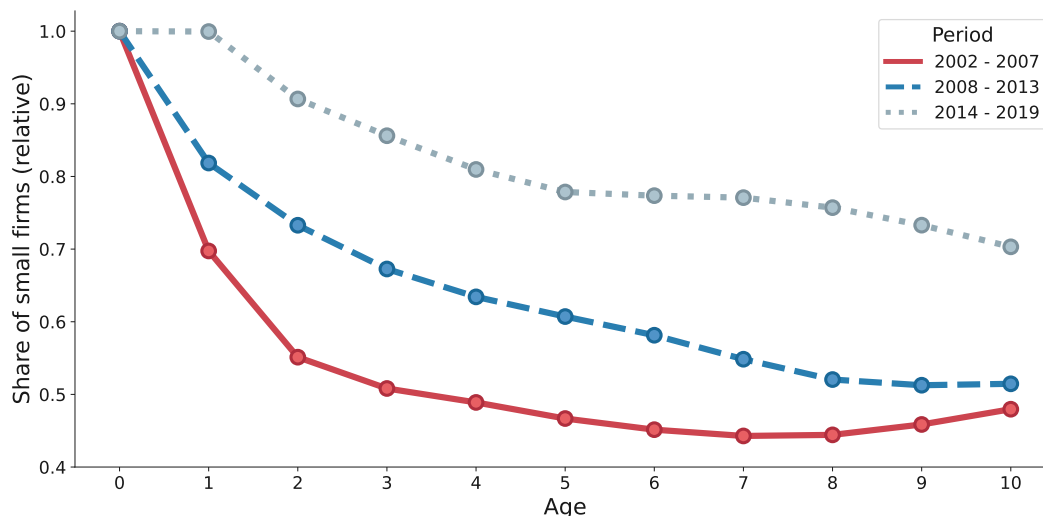


Figure 5: Faltering business dynamics in Ukraine: Declining business selection over time

Notes: The figure plots the (relative) share of small firms in three periods; 2002–2007, 2008–2013, and 2014–2019. A firm is defined as a small firm if its employment is less than or equal to four. Vertical axis plots the relative share of small firms, where it is equal to the ratio of the share of small firms in a period $\times$ age bin to the share of small firms of zero-year old cohorts in the same period.

Motivated by this insight, Figure 5 examines the evolution of small-firm shares within entry cohorts over time in Ukraine. The evidence reveals a sharp deterioration in selection dynamics. Before 2008, selection appeared strong: within five years of entry, the share of small firms in a cohort declined by more than 50 percent, indicating active reallocation toward more productive and larger firms. This pattern breaks down after 2014, when the decline in small-firm share falls to just 20 percent over the same time horizon. This weakening of selection, coinciding with rising market concentration and a slowdown in firm dynamism, suggests a broader erosion in the mechanisms that support productivity-enhancing growth.

The change in business dynamism, from a model of “up or out” to one of “flat and stay”, is a warning sign that the market system is not balancing the economic forces of *creation*, *preservation*, and *destruction*. Erosion of market selection gives unproductive firms room to persist, while crowding out space for new and dynamic entrepreneurs. The result is a misallocation of resources across the Ukrainian economy, leading to reduced efficiency, slower growth, fewer job opportunities, and downward pressure on wages.⁶

2.4 Decoupling productivity and market share

In a well-functioning economy, more productive firms expand while less productive firms contract. Accordingly, an efficient allocation of resources implies a strong positive relationship between firm size and productivity. Additional evidence of dampening business dynamism in Ukraine comes from assessing the relationship between business productivity and resource allocation (Figure 6).

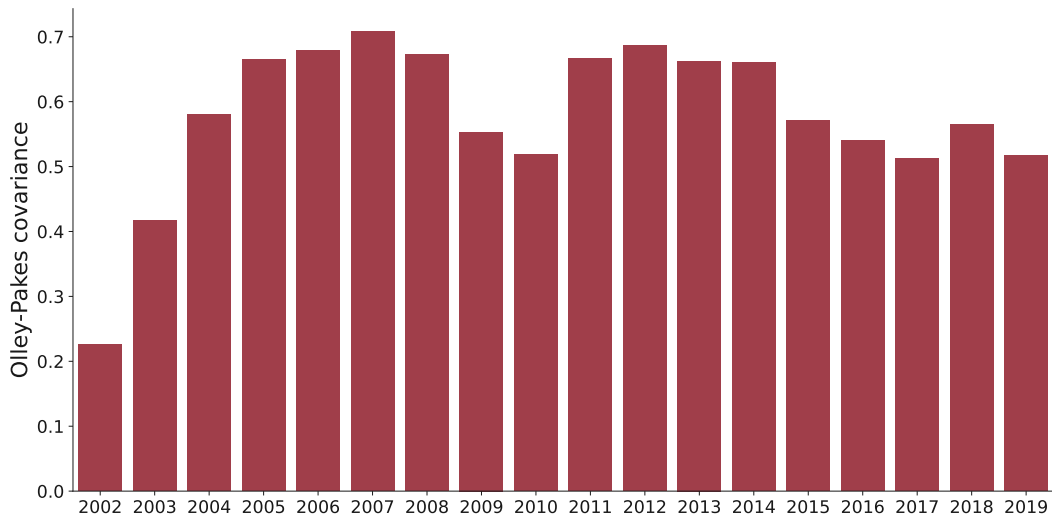


Figure 6: Productive businesses in Ukraine are unable to expand - weakening relationship between productivity and size

Notes: The figure plots the covariance term of the Olley-Pakes decomposition of aggregate productivity over years. Aggregate log labor productivity in a year equals $\sum_i \omega_i z_i$, where i is firm, ω_i is firm’s employment share in the year, and z_i is firm’s log labor productivity. Olley-Pakes decomposition states that $\sum_i \omega_i z_i = \frac{1}{N} \sum_i z_i + \sum_i (z_i - \bar{z}) \left(\omega_i - \frac{1}{N} \right)$, where N is the number of firms, and $\bar{z}$ is the unweighted average of firm level log labor productivities. The covariance term from this decomposition is the second term on the right hand side of this identity. It reflects the association between a firm’s productivity and its relative size.

⁶Further, the Russian occupation of Crimea, Donetsk, and Luhansk has undermined business dynamism regionally as well as nationally. Between 2002 and 2013, Crimea, Donetsk, and Luhansk had some of the most dynamic firms in the economy, outpacing their peers with a 40 percent steeper business life cycle (see Figure A1).

Building on the seminal work of Olley and Pakes (1996) that examines the extent to which productive businesses grow and expand their market share, we find three distinct patterns in Ukraine. Between 2002 and 2007, there is a rising association between business productivity and size, as measured by employment. This association flattens between 2007 and 2012 and then starts declining between 2013 and 2019. These trends highlight that productive businesses are not being able to expand, dampening overall business dynamism.

2.5 Declining Responsiveness to Productivity Shocks

A key mechanism linking firm-level dynamics to aggregate productivity growth is the economy's responsiveness to productivity shocks. This term refers to the extent to which firms adjust their input use, particularly labor, in response to idiosyncratic changes in their productivity. When a firm experiences a positive productivity shock, economic efficiency requires that it expand and absorb more resources; conversely, less productive firms should contract and release resources. This reallocation process ensures that labor and capital are increasingly concentrated in the most efficient firms, thereby raising aggregate productivity.

We follow Decker et al. (2020) to estimate the firm level employment responsiveness to observed productivity shocks. Particularly, we estimate the following regression equation,

$$g_{i,t,t+1} = \beta_0 + \beta_1 \ln a_{i,t} + \beta_2 \ln e_{i,t} + \gamma_{j,t} + \gamma_r + \varepsilon_{i,t+1} \quad (1)$$

where i and t denote firm and time, respectively, $g_{i,t,t+1}$ denotes the Davis-Haltiwanger-Schuh (DHS) growth rate of employment from t to $t + 1$, which is defined as

$$g_{i,t,t+1} = (e_{i,t+1} - e_{i,t}) / (0.5 \times (e_{i,t+1} + e_{i,t})),$$

and $e_{i,t}$ denotes firm's employment in year t (Davis et al., 1996). Firm's revenue labor productivity in year t is denoted by $a_{i,t}$. Lastly, we add 4-digit-sector $\times$ year and region fixed effects ($\gamma_{j,t}$ and γ_r terms). We estimate equation (1) with OLS for three periods separately; 2002-2007, 2008-2013 and 2014-2019. Average responsiveness to productivity shocks in each period is measured by the productivity coefficient, β_1 , after controlling for firm's past employment and fixed effects.

Results are displayed in Figure 7. All coefficients are statistically significant and a clear declining trend in responsiveness emerges. The semi-elasticity of DHS growth rate of employment to productivity shocks is estimated to be around 0.13 between 2002 and 2007, whereas this elasticity had declined by 21% in the next five years followed by another 21% decline in the last period 2014–2019. This declining trend in firm responsiveness slows down the resource reallocation in the economy. That is, factors are more slowly allocated towards the firms that experience positive productivity growth.

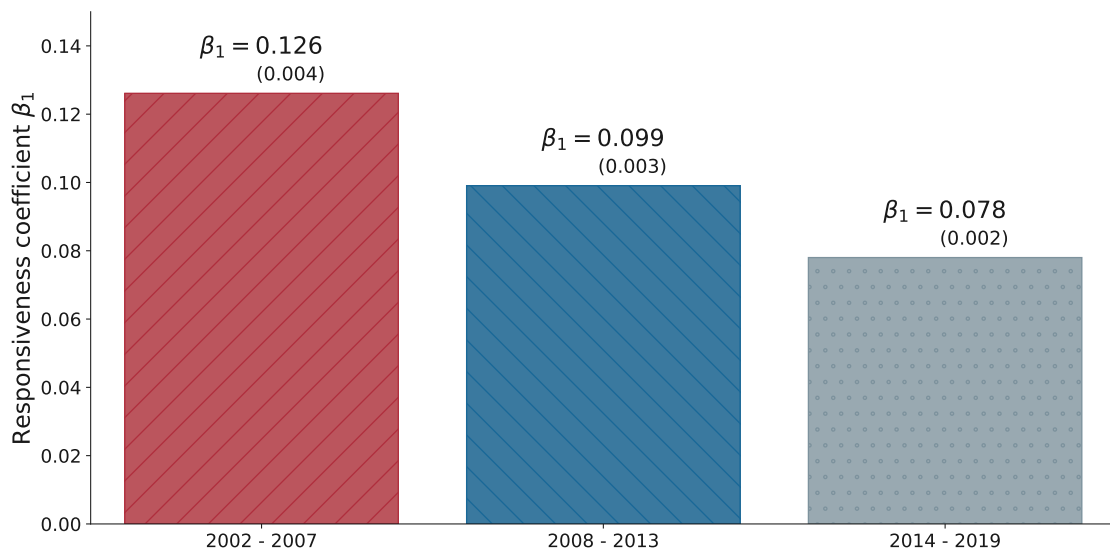


Figure 7: Firms' employment responsiveness to productivity shocks has decreased over time

Notes: The figure shows the OLS estimates of the coefficient β_1 in regression equation (1) for three periods; 2002–2007, 2008–2013 and 2014–2019. Standard errors are given in parentheses.

This declining trend in responsiveness implies a weakening of the reallocation channel through which productivity gains at the firm level translate into aggregate improvements. When firms experiencing positive productivity shocks are unable to expand efficiently, due to frictions, rigidities, or institutional barriers, labor and capital remain trapped in less productive firms.

2.6 Declining contestability

Entrants bring change in the form of enterprises with new products or production processes, workers with new skills and ideas, or energy sources such as renewables that embody new technologies. Incumbents bring scale and can compete with entrants in the market to jointly expand a country's technological capabilities, moving the country closer to the global technology frontier.

In Schumpeterian dynamics, entrants are vital because they drive new technologies and challenge established firms through creative destruction. Unlike incumbents, they are not tied to existing markets, allowing them to take risks and introduce disruptive ideas. However, fewer young firms are entering the market, and the share of jobs in young firms is also declining (Figures 8 and 9).

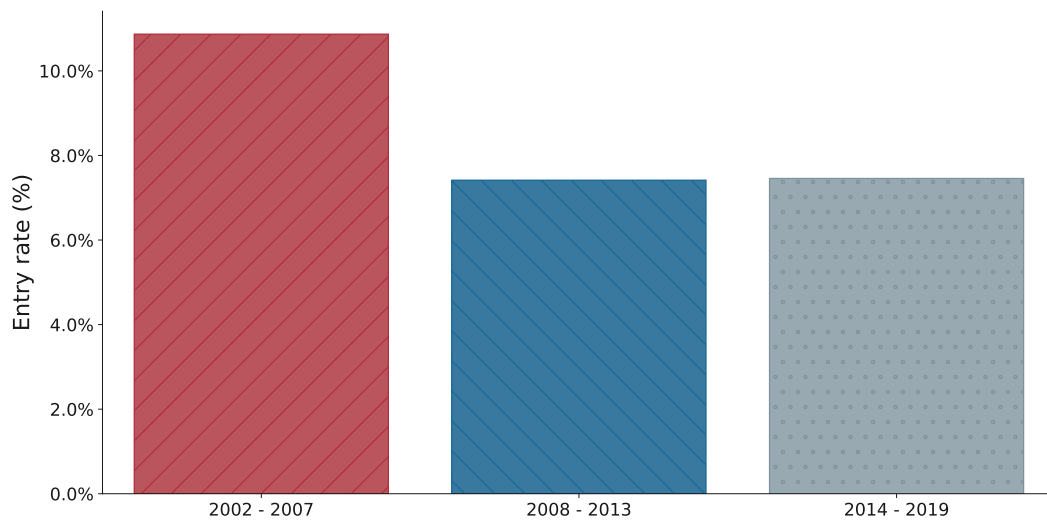


Figure 8: Entry rate of new firms

Notes: The figure plots the average firm entry rate in the manufacturing sector over periods. Entry rate in a year is defined as the ratio of the number of zero-year old firms in the industry to the total number of existing incumbents operating in the industry in the same year. Annual entry rates are aggregated into periods with unweighted average.

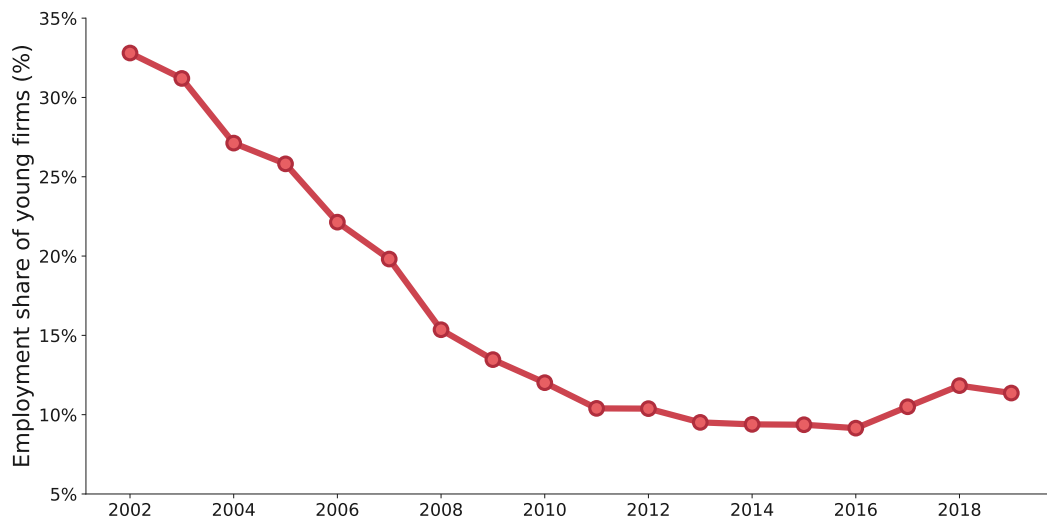


Figure 9: Fewer young firms challenging the status quo in Ukraine

Notes: The figure plots the average share of employment in 4-digit manufacturing industries accounted for by young firms. A firm is identified as a young firm in a year if it is five year old or younger. Employment share of young firms in a 4-digit industry is calculated as the ratio of total employment of young firms to the total employment of the 4-digit industry. Average employment share of young firms in a year is then calculated as the weighted average of 4-digit industry level employment share of young firms, where industry weights equal to the industry's employment share in the 1-digit manufacturing sector in that year.

Not only is contestability weakened by dampened entry rates, but it is also exacerbated by

rising market concentration among the largest businesses (Figure 10). The four largest businesses in manufacturing sectors (disaggregated at the 4-digit level) account for close to 53 percent of industry sales in 2019, up from 48–49 percent in early 2000s. By contrast, in the United States, one of the most concentrated economies worldwide, the four largest businesses account for close to 44 percent of industry sales (Autor et al., 2017). In general, a small number of companies dominate markets in emerging markets and developing countries (World Bank, 2024), and in principle, market concentration by itself is not a worrying indicator. However, in Ukraine, market concentration is accompanied by low business dynamism and declining productivity growth, suggesting that market leaders are not using their resources for productive uses.

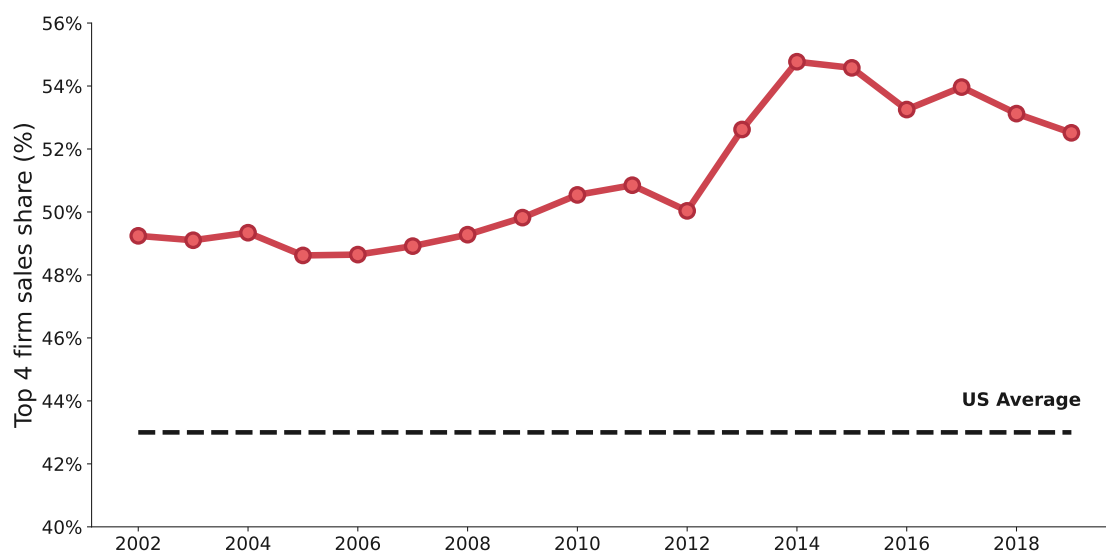


Figure 10: Ukraine's Manufacturing Sector Exhibits Increasing Concentration Over Time

Notes: The figure plots the average share of sales accounted for by the top largest 4 firms in a 4-digit manufacturing industry over years. Average concentration in a year is calculated as the weighted average of 4-digit industry level concentration, weights being equal to industry's employment share in the 1-digit manufacturing sector in that year. Red dashed line shows the value of the same moment for the US (Autor et al., 2017).

2.7 Overreach by the state

The state's presence in contestable sectors such as manufacturing exacerbates market concentration and dampens business dynamism. Public ownership, coupled with weak governance, creates substantial barriers to entry, mirroring the evidence from China in Brandt et al. (2025), where state control distorted market access and suppressed competitive pressures. In Ukraine, State-Owned Enterprises act as entrenched incumbents that constrain the economy's productive potential.

Our analysis of SOEs highlights three key patterns (Figure 11).

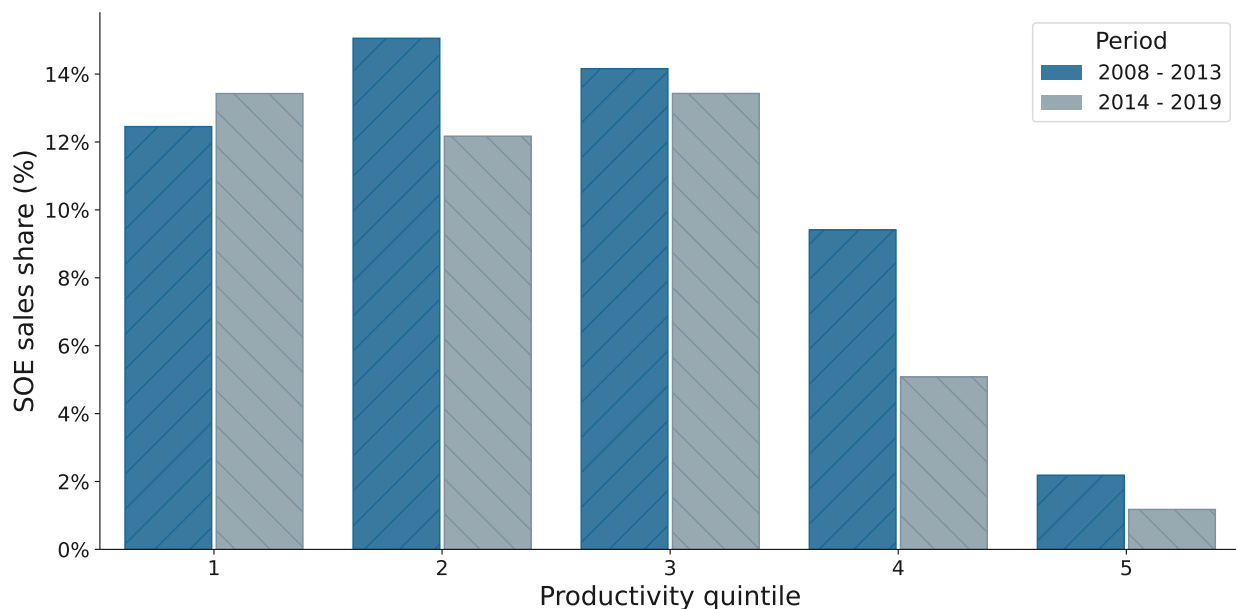


Figure 11: State Owned Enterprises crowd out private businesses and are overrepresented among the least productive businesses

Notes: The figure plots the average share of sales accounted for by the state owned enterprises in the manufacturing sector as a function of their relative labor productivities for two time periods; 2008–2013 and 2014–2019. Relative productivity of an SOE is determined by its position in the labor productivity distribution. The vertical axis shows the average sales share of SOEs in each labor productivity quintile. Blue bars show values for the period 2008–2013. Gray bars show values for the period 2014–2019.

- First, SOEs account for a significant share of sales in manufacturing industries, effectively crowding out private enterprise.
- Second, SOEs are overrepresented among laggard firms, with the productivity gap increasing over time. SOEs represent about 13 percent of sales in the lowest two productivity quintiles.
- Third, SOEs are missing among productive firms. Between 2008 and 2013, SOEs contributed 2 percent of the sales in the most productive quintile and 9 percent in the second most productive quintile. Between 2014 and 2019, these figures dropped to 1 percent and 5 percent respectively.

These findings are consistent with insights from global research showing that enterprises with majority or minority state shareholdings act as powerful incumbents. A doubling of states' market share in a given sector is associated with 5-35 percent lower entry rate and the financial performance of SOEs lags that of their private peers (World Bank, 2024). On average, SOEs have lower labor productivity, profitability, and return on investments (World Bank, 2023).

There is a delicate balance between SOEs serving as early-stage catalysts that attract private

investment into a sector and becoming entrenched incumbents that crowd out competition. While Brandt et al. (2025) provide evidence that SOEs in China have often played the latter role, the Chinese electric vehicle (EV) industry offers a successful example of the former (Akcigit et al., 2025c). In its early stages, SOEs played a critical role by absorbing investment risks, stimulating demand, and developing essential infrastructure, effectively laying the groundwork for market formation. This strategic involvement helped establish the ecosystem necessary for private firms to enter and compete. As the sector matured, private companies such as BYD, NIO, and XPeng became the primary engines of innovation and growth, while SOEs gradually receded into a minority role. The result is a globally competitive and predominantly private-led EV industry, demonstrating a rare example of how carefully designed and time-bound state intervention can enable, rather than stifle, early-stage private sector dynamism. Unfortunately, Ukrainian SOEs appear to be far from replicating this model.

2.8 Recycled foreign investment

Foreign Direct Investment has an important role to play in stimulating growth.⁷ The 2024 World Development Report highlights that openness and reforms are key ingredients for countries to infuse global technologies and advance economic progress. These are invigorated through paths such as trade and FDI alongside pro-competition regulation, licensing, and knowledge exchanges. Estonia for example had FDI inflows during the 1990s that were seven times that of Bulgaria and three times that of Poland. While over the last three decades, Bulgaria, Estonia, and Poland have transitioned simultaneously from central planning to market economies, Estonia had reached 80 percent of Western European income, Poland 75 percent, and Bulgaria 50 percent.

In general, FDI is a key instrument for technological advancement and economic growth. However, the benefits of FDI in Ukraine are mixed. Significant FDI in Ukraine is classified as tax haven “round-trip” investment. This means that domestic investors route their money through offshore financial centers and reinvest it back into their own companies. This practice allows them to enjoy the legal and financial benefits of foreign ownership without bringing new capital or technology into the country. A recent study shows that non-tax haven FDI boosts employment by up to 30 percent, with gains continuing to grow over the following five years. These firms also see significant increases in productivity, including a 19 percent rise in labor productivity and a 12 percent improvement in TFP (Shpak, 2024).

In contrast, firms receiving FDI from tax havens experienced much smaller benefits. Employment increased by only 18 percent, and labor productivity gains were a modest 11 percent. More strikingly, there was no significant improvement in TFP. Furthermore, analysis done for this

⁷For evidence on the link between FDI and economic growth through various channels, including capital accumulation, technology transfer, and productivity spillovers, see, among others, Borensztein et al. (1998), Javorcik (2004), and Alfaro et al. (2004).

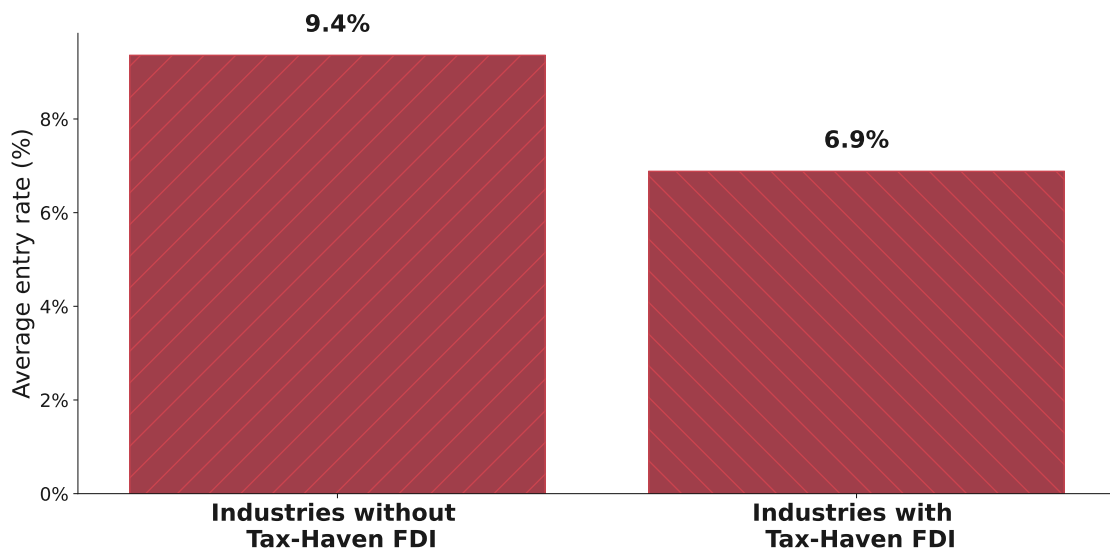


Figure 12: Industries receiving FDI from tax-havens have lower business dynamism, measured here through entry rates

Notes: The bar chart shows the average entry rate in 4-digit manufacturing industries depending on the type of FDI they receive between 2002 and 2013. Tax-haven countries are listed in Shpak (2024). Non-tax-haven countries constitute the remaining countries.

paper shows that industries receiving FDI from tax haven countries exhibit significantly lower business dynamism, with 27 percent less entry (Figure 12).

3 Prioritizing Creative Destruction: A Framework

The stylized facts presented in the previous section highlight how rising incumbent dominance as well as stunted growth of productive firms is holding back the Ukrainian economy. To identify the priorities and sequencing of policies for reform, we develop a dynamic model of endogenous innovation and institutional capture that serves as the backbone of our analysis. The model is designed to capture key features of the Ukrainian economy, a stylized economy characterized by uneven institutional quality and heterogeneous innovation capacity. Building on Klette and Kortum's framework, the economy comprises a continuum of differentiated product lines, each of which can be operated either by a competitive firm or by an *entrenched firm*, an entity that gains control of production not through technological superiority but by exploiting regulatory or bureaucratic mechanisms.

Product lines can shift between *fair* and *captured* institutional states: in the fair state, firms compete on the basis of productivity and innovation; in the captured state, entrenched firms impose administrative barriers that raise the costs of their competitors, enabling them to take over production despite lagging behind technologically. Competitive firms endogenously invest

in R&D to expand and innovate, while entrenched firms passively benefit from technological spillovers. The model features endogenous firm dynamics, heterogeneous innovation capabilities (as in Acemoglu et al. (2018); Akcigit et al. (2021, 2025b)), and institutional transitions that jointly determine firm size, resource allocation, and economic growth. What follows is a detailed description of the model environment in Ukraine.

3.1 Final Goods Production and Demand

Time is continuous. The final good is produced using a continuum of intermediate varieties indexed by $j \in [0, 1]$, aggregated via a constant elasticity of substitution production function with unit elasticity:

$$Y_t = \exp \left[\int_0^1 \ln y_{jt} dj \right], \quad (2)$$

where y_{jt} denotes output of intermediate variety j at time t , and Y_t is aggregate output.

3.2 Intermediate Production and Institutional States

Each intermediate product line can be operated by either a competitive firm or an *entrenched firm*. Output is linear in labor:

$$y_{ijt} = a_{ijt} \cdot l_{ijt}, \quad i \in \{n, s\}, \quad (3)$$

where $i = n$ denotes a non-entrenched (competitive) firm and $i = s$ denotes an entrenched firm, with a_{ijt} as productivity and l_{ijt} as labor input.

Each product line is subject to an institutional regime: either *fair* or *captured*. In the fair regime, competitive firms operate the product and earn profits. In the captured regime, an entrenched firm—protected by regulatory or administrative barriers—raises the marginal cost of the non-insider firm, eliminating its competitive advantage and assuming control of production. Although insider firms are one step behind in productivity, institutional frictions level marginal costs, allowing them to produce. Entrenched firms do not invest in innovation.

Transitions between institutional states are stochastic. Fair product lines are captured at rate δ , and captured lines revert to fair at rate of creative destruction τ . These transitions model the race between institutional erosion and innovation, respectively.

3.3 Firms, Innovation, and Product Portfolios

Firms may operate multiple product lines and expand through innovation. Upon a successful innovation, a firm improves the productivity of one randomly selected line by a factor $\lambda > 1$, displacing any incumbent and resetting the institutional status to fair.

A growing literature emphasizes that entrepreneurial ability is highly heterogeneous. Schoar (2010) and Hurst and Pugsley (2011) argue that only a small subset of entrepreneurs have the potential to scale and drive transformative growth. Most recently, Akcigit et al. (2025b) show that this subset is characterized by higher cognitive ability, greater innovation output, and superior job creation. Motivated by these empirical findings, our model features firms that are heterogeneous in their R&D capability. Entrants draw a type upon entry:

- High-type "transformative" firms (H) have positive R&D productivity and can expand.
- Low-type "subsistence" firms (L) do not innovate.

Each entrant begins with a single product. Firms exit if they lose all their product lines due to creative destruction.

A firm is characterized by the pair (n, m) , where n is the number of fair product lines and m is the number of captured lines it originally owns.

The firm's innovation rate depends on the number of product lines and employed researchers. A firm with R researchers and $n + m$ product lines innovates at rate:

$$X = (n + m)^{1 - \frac{1}{\eta}} (\theta_i \cdot R)^{\frac{1}{\eta}}, \quad i \in \{H, L\},$$

where θ_i is the firm's R&D productivity and $\eta > 1$ reflects diminishing returns.

Creative destruction occurs at rate τ per line, displacing incumbents regardless of their type or institutional status.

The economy features a unit measure of potential entrants, each of which engages in R&D activity in an attempt to enter the market. Upon successful entry, a firm draws its type: with probability p_H , the entrant is a transformative type, capable of innovating, and with probability $p_L = 1 - p_H$, it is a subsistence type that lacks innovative potential.

Entrants possess R&D productivity denoted by $\tilde{\theta}$, and their R&D technology mirrors that of an incumbent firm with a single product line.

Let $\tilde{R}$ denote the amount of labor hired by an entrant for R&D. The entrant's R&D technology is given by:

$$\tilde{x} = (\tilde{\theta} \cdot \tilde{R})^{1/\eta}.$$

where $\tilde{x}$ is the entry rate and $\eta > 1$ governs the curvature of the innovation cost function. This structure implies convex costs of innovation effort, with the elasticity governed by the parameter $\eta > 1$.

3.4 Equilibrium

Next, we solve for the equilibrium of this model. We will first describe the static production decision, and then turn into the dynamic decision where firms decide how to expand their firms.

Firm Pricing and Profits

The production function specified in equation (2) implies unit-elastic demand for each product variety. As a result, the revenue generated by any given variety equals total final output:

$$p_{jt}y_{jt} = Y_t.$$

This property leads to constant markups and significantly simplifies the aggregation of firm-level profits. Firm profits can therefore be expressed as:

$$\begin{aligned}\Pi_{jt} &= (\text{price} - \text{marginal cost}) \times \text{quantity} \\ &= \left[p_{jt} - \frac{W_t}{a_{ijt}} \right] \frac{Y_t}{p_{jt}}.\end{aligned}$$

where W_t denotes the wage rate.

We assume firms compete à la Bertrand. In this setting, the price is set equal to the marginal cost of the next-best (displaced) producer, implying:

$$p_{jt} = \frac{W_t \lambda}{a_{ijt}},$$

where $\lambda > 1$ reflects the productivity gap between the incumbent and its nearest competitor.

Substituting this pricing rule, profits are strictly positive only in *fair* sectors, where competition takes place on the basis of productivity. The resulting per-line profit is the same for all product lines $j \in [0, 1]$ and equals:

$$\Pi_{jt} = \underbrace{\left(1 - \lambda^{-1}\right)}_{\equiv \pi} Y_t.$$

Firm Value and Innovation Incentives

Let $V_{n,m}$ denote the value of a firm that controls n fair (i.e., competitively held) product lines and m captured (i.e., institutionally blocked) lines. The firm's dynamic program incorporates both innovation and destruction margins. As stated before, δ denotes the rate at which insider firms capture product lines, analogous to the standard creative destruction rate τ , but stemming

from institutional capture rather than technological progress.⁸ The firm chooses R&D effort X to maximize its expected value, which satisfies the following Hamilton-Jacobi-Bellman (HJB) equation:

$$rV_{n,m} - \dot{V}_{n,m} = \max_{X \geq 0} \left\{ n\pi Y_t - \frac{1}{\theta}(n+m) \left(\frac{X}{n+m} \right)^\eta W_t + X(V_{n+1,m} - V_{n,m}) \right. \\ \left. + \tau n(V_{n-1,m} - V_{n,m}) + \tau m(V_{n,m-1} - V_{n,m}) + \delta n(V_{n-1,m+1} - V_{n,m}) \right\}. \quad (4)$$

This continuous-time value function has a straightforward interpretation. The firm earns flow profits of $n\pi Y_t$, generated by its fair product lines. It incurs R&D costs given by $\frac{1}{\theta}(n+m) \left(\frac{X}{n+m} \right)^\eta W_t$. Successful innovation occurs at rate X , in which case the firm acquires an additional fair product line, increasing its value by $V_{n+1,m} - V_{n,m}$.

At rate τn , a fair product line is subject to creative destruction, reducing the firm's holdings of fair lines and lowering its value by $V_{n,m} - V_{n-1,m}$. Similarly, at rate τm , a captured product line is displaced by innovation from an external competitor. In this case, the firm loses access to the product line entirely, including its use in R&D, causing a decline in value equal to $V_{n,m} - V_{n,m-1}$.

In contrast, insider firms expand via institutional means at rate δn , converting a fair line into a captured one. While the firm loses profits associated with that line, it retains the underlying knowledge, so its value falls by $V_{n,m} - V_{n-1,m+1}$. By construction, further insider entrenchment on already-captured lines does not affect the firm's value, since it retains access to the knowledge embedded in those lines regardless of which insider has captured them. This implies the term $\delta m(V_{n,m} - V_{n,m}) = 0$ drops out of the HJB equation.

Let $x \equiv \frac{X}{n+m}$ denote the firm's per-product-line innovation intensity, and define the normalized wage as $\omega \equiv \frac{W}{Y}$. These normalizations streamline the characterization of equilibrium behavior and firm decision-making.

Proposition 1 *The firm's value function is linear in the number of product lines and takes the form:*

$$V_{n,m} = n \cdot v^f \cdot Y + m \cdot v^c \cdot Y,$$

where v^f denotes the normalized value of a fair product line, that is, one from which the firm earns operating profits, and v^c denotes the normalized value of a captured product line, which does not generate profits but can still be leveraged for innovation.

⁸ δ and τ are both product-line-level destruction rates. However, τ reflects Schumpeterian creative destruction driven by innovation, while δ reflects the takeover of fair product lines by institutional insiders.

The constants v^f and v^c satisfy the following system of equations:

$$\begin{aligned}(r - g)v^f &= \pi - \frac{1}{\theta}x^\eta\omega + xv^f - \tau v^f + \delta(v^c - v^f), \\ (r - g)v^c &= -\frac{1}{\theta}x^\eta\omega + xv^f - \tau v^c,\end{aligned}$$

where r is the real interest rate, g is the growth rate of the economy, and τ and δ denote the rates of creative and institutional destruction, respectively.

Proof. See Appendix B. ■

Given the result in Proposition 1 that shows the linear form of the value function, the firm's optimization problem yields the following first-order condition with respect to innovation intensity. Solving for x , the per-product-line innovation effort, we obtain:

$$x = \left(\frac{\theta v^f}{\eta \omega} \right)^{\frac{1}{\eta-1}}. \quad (5)$$

This condition equates the marginal cost of R&D effort, adjusted for R&D efficiency and wage intensity, to the marginal value of a successful innovation, which increases the firm's number of profitable (fair) product lines.

Solving the system in Proposition 1 yields a closed-form expression for the value functions. Moreover, the second equation in the system along with the optimal innovation decision (5) directly implies that the value of a captured (or corrupt) product line is given by:

$$v^c = \frac{\frac{\eta-1}{\theta}x^\eta\omega}{r - g + \tau}. \quad (6)$$

Combining these expressions, the value of a fair product line can be written as:

$$v^f = \frac{\pi}{r - g + \tau + \delta} + \frac{\frac{\eta-1}{\theta}x^\eta\omega}{r - g + \tau}. \quad (7)$$

These expressions admit a straightforward interpretation. The value of a captured product line reflects only its role in enabling R&D. Since captured lines do not generate profits, their value corresponds to the present discounted value of future innovation opportunities. The effective discount rate $(r - g + \tau)$ in equation (6) does not include the institutional destruction rate δ , because additional capture by other insider firms does not erode the incumbent firm's knowledge advantage, it retains access to the frontier technology for R&D purposes.

In contrast, the value of a fair product line consists of two components: the R&D option value, as in the captured case, and the present discounted value of the profit stream the firm earns while it retains exclusive control. This profit stream is subject to termination through both creative destruction (τ) and institutional capture (δ), hence the combined discount term $r - g + \tau + \delta$ in the first term of equation (7).

Entry

Entrants observe their type only after a successful innovation. With probability p_H , an entrant is a high type that can utilize captured product lines for future R&D, while with probability $p_L = 1 - p_H$, the entrant is a low type that cannot. Firms do not switch types after entry.

Let v_H^f and v_L^f denote the values of a fair product line for high- and low-type entrants, respectively.⁹ The expected value of a product line upon entry is then given by:

$$\bar{v}^f := p_H v_H^f + p_L v_L^f = \frac{\pi}{r - g + \tau + \delta} + p_H \cdot \frac{\frac{\eta-1}{\theta} x^\eta \omega}{r - g + \tau}. \quad (8)$$

Each entrant chooses an innovation intensity $\tilde{x}$ to maximize its expected net payoff, given by:

$$\max_{\tilde{x}} \left\{ -\frac{1}{\tilde{\theta}} \tilde{x}^\eta \omega + \tilde{x} \cdot \bar{v}^f \right\} Y_t,$$

where $\tilde{\theta}$ is their R&D productivity. The corresponding first-order condition yields the entrant's equilibrium innovation intensity:

$$\tilde{x} = \left(\frac{\tilde{\theta} \bar{v}^f}{\eta \omega} \right)^{\frac{1}{\eta-1}}. \quad (9)$$

Labor Market Clearing

Total labor force in the economy is denoted by L . Labor is employed in three capacities in this economy: production, R&D by incumbent (transformative) firms, and R&D by entrants. Each component contributes to aggregate labor demand.

The demand for production workers is determined by the unit-elastic demand structure and equals $\lambda^{-1} \omega^{-1}$, where $\lambda > 1$ is the markup and ω is the normalized wage.

Transformative incumbents undertake R&D to expand their product portfolios. Each product line requires $\frac{1}{\theta} x^\eta$ units of R&D labor, where x is the per-line innovation intensity and θ is R&D

⁹The difference between v_H^f and v_L^f stems from the difference between R&D efficiency of H and L types. R&D productivity of L -type firms is zero. Therefore, replacing $x = 0$ in (7) yields $v_L^f = \frac{\pi}{r-g+\tau+\delta}$. More formally, as $\theta \rightarrow 0$, $\frac{x^\eta}{\theta} \rightarrow 0$ because $\eta > 1$.

productivity. Aggregating across all product lines owned by transformative firms yields total R&D labor demand of:

$$M_H \cdot \frac{1}{\theta} x^\eta,$$

where M_H denotes the total mass of product lines held by transformative incumbents. Entrants also invest in R&D, hiring a total of $\frac{1}{\tilde{\theta}} \tilde{x}^\eta$ units of labor to achieve innovation intensity $\tilde{x}$.

Combining all components, the labor market clearing condition is given by:

$$L = \frac{1}{\lambda\omega} + M_H \cdot \frac{1}{\theta} x^\eta + \frac{1}{\tilde{\theta}} \tilde{x}^\eta. \quad (10)$$

The mass of transformative product lines, M_H , is pinned down by equilibrium firm dynamics. Each successful entrant becomes a transformative firm with probability p_H , and owns k product lines with probability proportional to $(\frac{x}{\tau})^k / k$, reflecting a geometric distribution of expansions through innovation.¹⁰ This yields:

$$M_H = \sum_{k=1}^{\infty} k \cdot \frac{p_H \tilde{x}}{x} \cdot \frac{(\frac{x}{\tau})^k}{k} = \frac{p_H \tilde{x}}{\tau - x}.$$

Institutional Capture, Misallocation, and Growth

Let $M_E \in [0, 1]$ denote the share of product lines operated by entrenched incumbents. The dynamics of M_E evolve according to:

$$\dot{M}_E = (1 - M_E)\delta - M_E\tau.$$

The first term on the right-hand side represents inflows into the entrenched state: among the share $1 - M_E$ of fair product lines, each is captured by entrenched firms at rate δ . The second term represents outflows: a fraction M_E of product lines are entrenched, and each is reversed back to fair line at the creative destruction rate τ .

In a balanced growth path (BGP), the stock of captured product lines is stationary, implying:

$$M_E = \frac{\delta}{\tau + \delta}. \quad (11)$$

To characterize the macroeconomic consequences of institutional capture, we next define

¹⁰See Appendix B for the derivations.

aggregate productivity as the geometric average of frontier productivities:

$$A_t = \exp \left[\int \ln a_{jt} dj \right].$$

Let a_{jt}^* denote the productivity level actually used in production. This is given by:

$$a_{jt}^* = \begin{cases} a_{jt} & \text{if } j \text{ is in a fair sector,} \\ a_{jt}/\lambda & \text{if } j \text{ is in a captured sector,} \end{cases}$$

where $\lambda > 1$ is the step size of innovation. That is, although capture does not reduce frontier productivity, it distorts its effective use.

Let Y_t denote aggregate output and L_j the labor allocated to product line j . Then:

$$\begin{aligned} \ln Y_t &= \int \ln(a_{jt}^* L_j) dj \\ &= \ln A_t - M_E \ln \lambda + \ln L_P, \end{aligned}$$

where L_P is total labor used in production. It follows that:

$$Y_t = \lambda^{-M_E} A_t L_P. \quad (12)$$

The term $\lambda^{-M_E} < 1$ reflects a misallocation wedge: even though innovation raises frontier productivity A_t , institutional capture limits the realization of this potential by distorting resource allocation. As a result, entrenched sectors depress the level of output, even though they do not directly affect the frontier itself.

To understand how institutional capture interacts with long-run growth, we examine the growth rate of output:

$$g_t \equiv \frac{d \ln Y_t}{dt}.$$

Differentiating equation (12), and noting that M_E and L_P are constant in BGP, we obtain: $g_t = \frac{d \ln A_t}{dt}$. Hence, output growth in the long run is determined entirely by the growth of aggregate productivity. To compute the growth rate of A_t , observe that:

$$\begin{aligned} \frac{d \ln A_t}{dt} &= \lim_{dt \rightarrow 0} \frac{\ln A_{t+dt} - \ln A_t}{dt} \\ &= \lim_{dt \rightarrow 0} \frac{1}{dt} \int \ln \left(\frac{a_{j,t+dt}}{a_{jt}} \right) dj. \end{aligned}$$

Since a_{jt} reflects frontier productivity, and innovations occur at rate τ , we have:

$$\ln \left(\frac{a_{j,t+dt}}{a_{jt}} \right) = \begin{cases} \ln \lambda & \text{with probability } \tau dt, \\ 0 & \text{with probability } 1 - \tau dt. \end{cases}$$

Thus, the expected productivity gain in each line is $\tau \ln \lambda$, implying:

$$g = \frac{d \ln A_t}{dt} = \tau \ln \lambda. \quad (13)$$

This result highlights that the aggregate growth rate is governed by the economy's innovation intensity τ , driven by transformative entrepreneurs and entrants, and the productivity gain per innovation λ .

While institutional capture imposes a static misallocation that depresses output levels through the wedge λ^{-M_E} , it also has dynamic consequences. Specifically, higher levels of capture (i.e., greater δ) reduce the expected duration of monopoly profits. As shown in equation (5), (7), (8), and (9), this weakens innovation incentives by lowering the value of developing new product lines. Thus, institutional capture not only suppresses output in levels but also inhibits long-run growth by undermining the incentives to innovate.

4 Quantitative Analysis

We now turn to the quantitative implementation of the model to bring together the theoretical framework and empirical patterns documented earlier. Our objective is to estimate the general equilibrium model of firm dynamics and institutional capture developed in the preceding sections, using data from the Ukrainian economy. By structurally estimating key parameters to match a set of targeted empirical moments, we construct a calibrated environment that replicates core features of Ukraine's firm dynamics, innovation behavior, and institutional frictions. This quantitative framework serves as a foundation for counterfactual policy experiments aimed at evaluating the implications of institutional entrenchment for growth, entry, and resource allocation, as well as the effectiveness of targeted industrial policy in economies with weak institutional environments.

4.1 Estimation

We estimate the model parameters with joint inference after externally calibrating three of them. The time period is set to one year. The annual time discount rate, ρ , is chosen 5%, a common value

found in the literature.¹¹ Following Akcigit and Kerr (2018), we set the curvature parameter of the R&D production function to $\eta = 2$, implying a quadratic and convex cost structure in innovation rates x and $\tilde{x}$. This assumption reflects diminishing returns to R&D effort and is standard in the endogenous growth literature. The last parameter we externally calibrate is the size of the labor force. We normalize it to one, i.e. $L = 1$. The remaining five parameters,

$$\Theta = \{\lambda, \theta, \tilde{\theta}, p_H, \delta\},$$

are jointly estimated by targeting five informative moments for the period between 2002 and 2013. We calibrate the model parameters by matching the model generated moments on the balanced growth path equilibrium to the average moments we calculate from the firm level micro data.

Denoting the vector of empirical and model-generated moments with $\mathcal{M}_i^E$ and $\mathcal{M}(\Theta)$, respectively, we estimate Θ by minimizing the sum of squared deviation between $\mathcal{M}_E$ and $\mathcal{M}(\Theta)$ with equal weights. That is, we minimize the following objective function

$$\min_{\Theta} \sum_{i=1}^5 \frac{1}{5} \left(\frac{\mathcal{M}_i(\Theta) - \mathcal{M}_i^E}{\mathcal{M}_i^E} \right)^2$$

Identification Strategy. While all structural parameters are estimated jointly in the general equilibrium model, we discuss below the moments that are most informative for each parameter.

Innovation step size (λ). The average annual growth rate of GDP per capita in Ukraine is a key target moment that disciplines the innovation step size parameter. In the model, the balanced growth rate satisfies the relationship $g = \tau \ln \lambda$, implying that a larger innovation step size leads to faster productivity growth. This moment therefore provides direct information on the scale of technological improvements per innovation event.

Firm growth efficiency (θ). To discipline the efficiency of firm growth, we target the average size of 10-year-old firms relative to entrants. This moment captures the steepness of the firm life cycle and is particularly sensitive to the parameter θ , which governs the efficiency of innovation effort. In the model, higher θ implies more persistent and faster growth among transformative (H-type) firms.

Entry efficiency ($\tilde{\theta}$). The average entry rate of new firms informs the cost of innovation for potential entrants and is primarily used to identify the R&D productivity parameter for entrants, $\tilde{\theta}$. A higher value of $\tilde{\theta}$ implies more efficient entry, consistent with observed firm creation rates.

Probability of being transformative (p_H). The probability that an entrant is an H-type firm is disciplined by the age-profile of small firms. Since transformative firms are more likely to grow

¹¹See Akcigit et al. (2021) and Akcigit and Ates (2023).

out of the small-size category over time, the decline in the share of small firms across age cohorts is informative about the composition of firm types. We target the average share of small firms in the cohort of 5-year-olds relative to that in the entering cohort to discipline p_H .

Entrenchment rate (δ). We identify the institutional capture parameter by targeting the extent of resource misallocation in the economy, measured through the correlation between labor productivity and size at the firm level. In the model, entrenchment distorts the allocation of production inputs, allowing less productive but entrenched firms to retain resources that would otherwise be used more efficiently. To strengthen identification, we incorporate an additional moment based on 4-digit sector-level variation in firm entry rates associated with exposure to tax-haven FDI. As shown in Appendix C.4, our quantitative results are robust to the inclusion of this additional moment.

Table 1: Model fit

	Moment	Model	Data	Source
M1	GDP per capita growth	5.8%	5.8%	World Bank WDI Dataset
M2	Firm life cycle profile (Age = 10)	8.09	8.09	FRD, author's calculations
M3	Firm entry rate	9.1%	9.1%	FRD, author's calculations
M4	Share of small firms (Age = 5)	52.5%	52.5%	FRD, author's calculations
M5	Labor productivity – size correlation	0.12	0.12	FRD, author's calculations

Notes: The table reports empirical moments and their model-implied counterparts used in estimation. Parameters are estimated by jointly minimizing the distance between empirical and simulated moments, with all moments targeted simultaneously. Empirical moments are constructed from the data sources listed in the final column.

Estimated parameters and model fit. Table 1 reports the empirical moments used for estimation alongside their model-implied counterparts.¹² As shown, the model exactly replicates all targeted moments.

Table 2 reports all calibrated parameters and their estimated values. We find that transformative firms (H -type) are approximately 7 times ($\approx \theta/\tilde{\theta}$) more R&D productive than potential entrants, underscoring the central role of incumbent innovators in driving aggregate productivity growth. The estimated innovation step size implies that successful innovations increase the productivity of a product line by about 8 percent on average.

Only 14 percent of new entrants are identified as transformative firms, highlighting the scarcity of high-potential firms in the economy. This raises an important policy question: how can such transformative firms be supported in scaling effectively, generating employment, and contributing to rising wages?

¹²Calculation of model implied moments are outlined in Appendix Section B.1.

Table 2: List of parameter values

Panel A: Externally calibrated			Panel B: Internally calibrated		
Parameter	Value	Description	Parameter	Value	Description
ρ	5%	Time discount rate	λ	1.078	Innovation step size
η	2	R&D func. curvature	θ	22.237	<i>H</i> -type R&D productivity
L	1	Labor force	$\tilde{\theta}$	3.284	Entrant R&D productivity
			p_H	13.59%	<i>H</i> -type entry probability
			δ	123.53%	Entrenchment rate

Finally, the estimated rate of institutional capture is substantial. Entrenched firms expand into new product lines at an average annual rate of 124 percent, implying that they add a new line to their portfolios roughly every 10 months ($\approx (1/\delta) \times 12$). This presents a major disincentive for R&D investment, as innovative firms face a significant risk of losing productive lines to entrenched incumbents through institutional rather than technological mechanisms.

4.2 Adverse Effects of Entrenchment on the Economy

Our quantitative analysis reveals that institutional entrenchment imposes sizable distortions on the broader economy of Ukraine. A central mechanism through which this occurs is the elevated risk that innovative firms face in holding onto their product lines due to institutional capture. When firms cannot retain the returns from innovation because of frequent appropriation by entrenched incumbents, their incentive to invest in R&D weakens considerably. This misalignment between productivity and market share undermines one of the fundamental features of a well-functioning economy: the ability of productive firms to expand and attract resources.

In a healthy market environment, we expect a strong positive correlation between firm productivity and size. However, Figure 13 shows that this relationship deteriorates significantly as the rate of entrenchment δ rises. The prevalence of entrenched firms leads to a substantial breakdown in allocative efficiency, weakening the natural selection process through which more productive firms grow larger. Consistent with this mechanism, the rise in entrenchment offers a compelling explanation for the increase in resource misallocation observed after 2008, as documented in Figure 6 in the empirical section.

This distortion extends to dynamic firm behavior. As shown in Figure 14, higher entrenchment attenuates firms' life cycle profiles. In response to the risk of appropriation, firms reduce their innovation effort and grow more slowly, even conditional on survival. This mechanism leads to flatter growth trajectories across the firm life cycle, a pattern consistent with the empirical decline in firm growth profiles documented for Ukraine across three distinct periods:

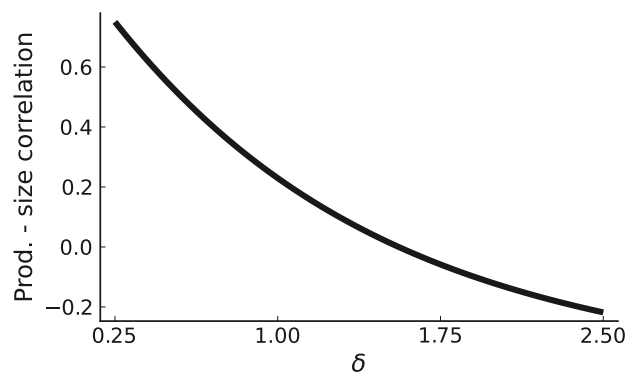


Figure 13: The effect of entrenchment δ on the firm productivity-size correlation

Notes: The figure shows the correlation coefficient derived from the structural model when δ varies while all other parameters are held constant at their calibrated values.

2002–2007, 2008–2013, and 2014 onward (see Figure 4).

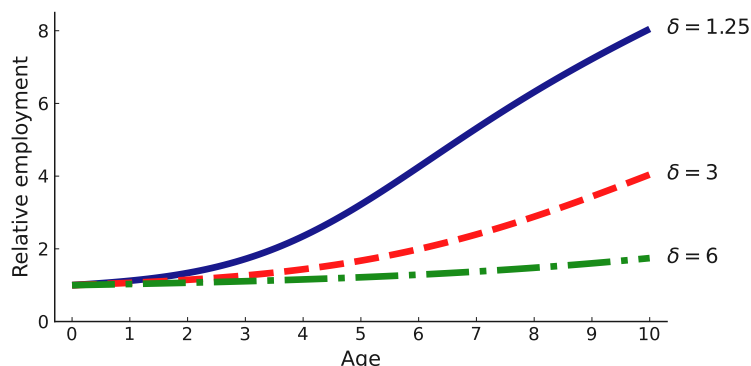


Figure 14: The effect of entrenchment δ on the firm life cycle profile

Notes: The figure shows the firm life cycle derived from the estimated model. Each line shows the counterfactual firm life cycle profile for three different values of $\delta \in \{1.25, 3, 6\}$. All other parameter values are held constant at their calibrated values. Appendix Section B.1.1 outlines the details on how the relative employment of each age bin is calculated from the structural model.

In addition to its adverse effect on incumbents' growth incentives, institutional capture also depresses entrepreneurial activity. Figure 15 illustrates that higher entrenchment leads to lower firm entry rates. The anticipation that new ventures may be appropriated even after successful entry discourages potential entrants from undertaking the fixed costs associated with starting a business.

The weakening of market selection has broader allocative consequences. When innovation incentives are muted and entry is discouraged, low-productivity subsistence firms are more likely to persist. Figure 16 shows that the share of small firms increases with entrenchment, reflecting a breakdown in the economy's ability to reallocate resources toward more efficient producers. This dynamic is consistent with the rising presence of small, stagnant firms observed in the Ukrainian

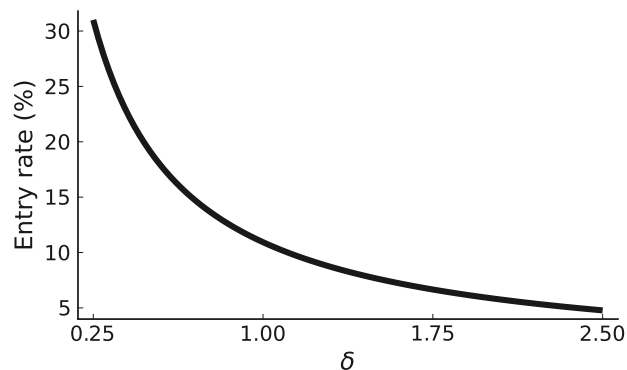


Figure 15: The effect of entrenchment δ on the firm entry rate

Notes: The figure shows the new firm entry rate derived from the structural model when δ varies while all other parameters are held constant at their calibrated values. Appendix Section B.1.3 outlines the details of how entry rate is calculated from the structural model.

firm data post-2008 (see Figure 5).

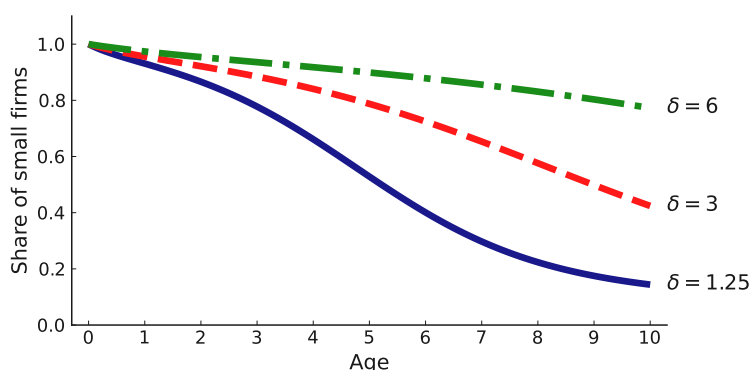


Figure 16: The effect of entrenchment δ on the selection mechanism

Notes: The figure shows the share of small firms in each age bin implied from the estimated model. Small firm in the model is defined as a firm with a single product line. Each line in the figure shows the counterfactual profile of share of small firms for three different values of $\delta \in \{1.25, 3, 6\}$. All other parameter values are held constant at their calibrated values. Appendix Section B.1.2 outlines the details on how the share of small firms in each age bin is calculated from the structural model.

Finally, institutional capture affects not only firm-level dynamics but also macroeconomic outcomes. As shown in Figure 17, higher entrenchment suppresses aggregate productivity growth. By simultaneously lowering innovation incentives, reducing entry, and distorting resource allocation, entrenchment generates widespread inefficiencies that translate into slower long-run growth.

Taken together, these results highlight the multifaceted impact of institutional entrenchment. Far from being a narrow or localized distortion, entrenchment undermines the dynamic forces of growth and selection, creating persistent frictions that affect both firm-level behavior and macroeconomic performance.

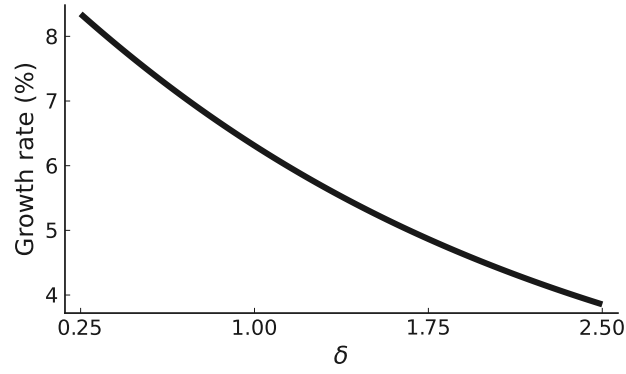


Figure 17: The effect of entrenchment δ on the long-run growth rate

Notes: The figure shows the long run rate of aggregate output growth g derived from the structural model when δ varies while all other parameters are held constant at their calibrated values. In the model, $g = \tau \ln \lambda$.

4.3 Policy Analysis

We now turn to a set of counterfactual policy experiments aimed at supporting innovation and entrepreneurship in Ukraine. Our focus is not only on the direct effects of these policies on incumbents and entrants but also on how their effectiveness is shaped by the degree of institutional entrenchment in the economy.

We consider two types of government support to firms, e.g. R&D subsidies for incumbent firms or potential entrants. Either of these policies are financed by lump-sum taxes on households.

In the first type of policy, the government subsidizes $s \in [0, 1]$ fraction of total R&D cost of incumbent firms. The effective cost of R&D then becomes $(1 - s) \cdot \frac{1}{\theta}(n + m) \left(\frac{X}{n + m}\right)^\eta$ for a firm that owns $n + m$ product lines. Replacing this cost into the HJB equation (4) results in:

$$rV_{n,m} - \dot{V}_{n,m} = \max_X \left\{ n\pi Y_t - (1 - s) \cdot \frac{1}{\theta}(n + m) \left(\frac{X}{n + m}\right)^\eta W_t + X(V_{n+1,m} - V_{n,m}) + \tau n(V_{n-1,m} - V_{n,m}) + \tau m(V_{n,m-1} - V_{n,m}) + \delta n(V_{n-1,m+1} - V_{n,m}) \right\}.$$

With a small adjustment to Proposition 1 and taking first-order condition gives the firm's optimal choice of innovation per-line as follows:¹³

$$x = \left(\frac{\theta v^f}{\eta(1 - s)\omega} \right)^{\frac{1}{\eta-1}}$$

¹³Under the subsidy regime, Proposition 1 and value functions slightly change. The term $\frac{1}{\theta}x^\eta\omega$ in Proposition 1 is multiplied by $1 - s$, and as a result, we derive the following value functions: $v^c = \frac{(1-s)\frac{\eta-1}{\theta}x^\eta\omega}{r-g+\tau}$ and $v^f = \frac{\pi}{r-g+\tau+\delta} + \frac{(1-s)\frac{\eta-1}{\theta}x^\eta\omega}{r-g+\tau}$. Thus, the expected value upon entry becomes $\bar{v}^f = \frac{\pi}{r-g+\tau+\delta} + p_H \cdot \frac{(1-s)\frac{\eta-1}{\theta}x^\eta\omega}{r-g+\tau}$.

All else equal, higher subsidy rate for incumbents, s , increases the rate of innovation x by lowering the effective cost of R&D for the firm.

The second type of government policy we consider is R&D subsidies for entrants. Denoting this subsidy rate by $\tilde{s} \in [0, 1]$, the effective cost of entry becomes $(1 - \tilde{s}) \cdot \frac{1}{\tilde{\theta}} \tilde{x}^\eta$, and potential entrants solve

$$\max_{\tilde{x}} \left\{ -(1 - \tilde{s}) \cdot \frac{1}{\tilde{\theta}} \tilde{x}^\eta \omega + \tilde{x} \cdot \tilde{v}^f \right\} Y_t.$$

The first-order condition is then given by

$$\tilde{x} = \left(\frac{\tilde{\theta} \tilde{v}^f}{\eta(1 - \tilde{s})\omega} \right)^{\frac{1}{\eta-1}}.$$

Similar to incumbent firms, entrant R&D subsidies reduce the cost of researchers for entrants encouraging them to innovate more, i.e. higher $\tilde{x}$.

We begin by analyzing a policy that subsidizes entry. Figure 18 presents the impact of entry subsidies on the economy's growth rate across different levels of entrenchment δ . The policy reduces the R&D cost of potential entrants, thereby encouraging new firm creation.

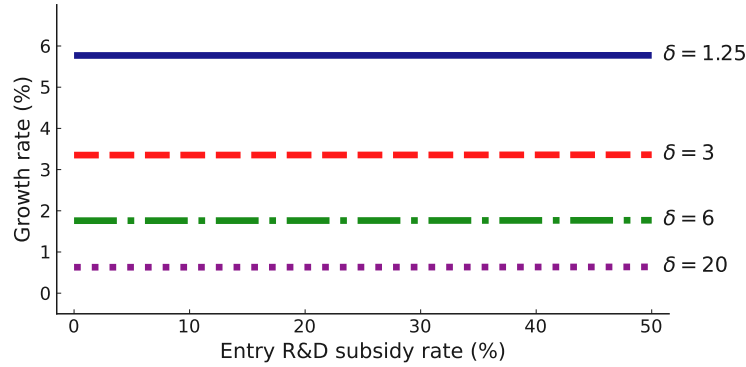


Figure 18: The effect of entrenchment δ on the effectiveness of government policy for entrants

Notes: The figure displays the long run rate of aggregate output growth g as a function of entry R&D subsidy rates $\tilde{s}$ under four different values of $\delta \in \{1.25, 3, 6, 20\}$. All other parameter values are held constant at their calibrated values given by Table 2. The entry subsidy rate $\tilde{s}$ changes between 0 and 0.5, while $s = 0$ at all times. This government policy is financed by lump-sum taxation of households.

The results are striking. Entry subsidies have little to no effect on long-run growth across all levels of entrenchment. This limited impact reflects the general equilibrium forces at play: while subsidies increase entry, they also raise equilibrium researcher wages and shorten the expected duration of monopoly profits. Both effects reduce the innovation incentives of transformative incumbents, leading to a crowding-out of high-impact R&D activity. Since entrants are typically less R&D productive than incumbents, the marginal gain from additional entry is small and fails to outweigh the negative effects on incumbent innovation.

Importantly, the ineffectiveness of entry subsidies persists across the full range of observed entrenchment levels in the Ukrainian economy. This underscores the limitations of targeting entry alone as a strategy for revitalizing growth in an environment characterized by institutional frictions.

Next, we consider a policy that subsidizes incumbent innovation. Figure 19 illustrates the effects of such a policy, again as a function of the entrenchment rate δ . In contrast to the entry subsidy, incumbent support has a positive effect on growth, particularly when the economy is less captured.

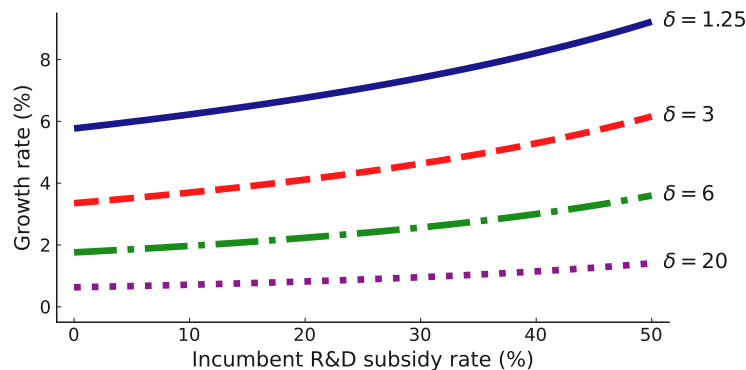


Figure 19: The effect of entrenchment δ on the effectiveness of government policy for incumbents

Notes: The figure displays the long run rate of aggregate output growth g as a function of incumbent R&D subsidy rates s under four different values of $\delta \in \{1.25, 3, 6, 20\}$. All other parameter values are held constant at their calibrated values given by Table 2. The incumbent subsidy rate s changes between 0 and 0.5, while $\tilde{s} = 0$ at all times. This government policy is financed by lump-sum taxation of households.

However, the efficacy of incumbent subsidies is significantly diminished in highly entrenched economies. Even though transformative incumbents are more capable of translating support into growth-enhancing innovation, institutional capture weakens their incentives by increasing the risk of losing product lines to non-productive insiders. As a result, the same policy becomes progressively less effective as entrenchment rises.

These findings point to a critical lesson for policy design: targeting firm types is not sufficient. Even perfectly targeted subsidies will have limited aggregate impact unless accompanied by institutional reforms that alleviate entrenchment and restore innovation incentives. The disciplining of entrenched firms is thus a necessary condition for growth-enhancing industrial policy in Ukraine.

5 Robustness and Validation

We conduct a series of robustness checks to assess the sensitivity of our empirical and quantitative findings. These analyses confirm that our main conclusions are not sensitive to reasonable

variations in sample, measurement, or modeling strategy.

Exclusion of War-Affected Regions. First, our empirical results are robust to excluding regions directly affected by armed conflict. When we re-estimate the key moments excluding the Donbas and Crimea (post-2014) as well as southern and eastern regions more broadly, our results on business dynamics, firm selection, and market concentration remain quantitatively and statistically similar (see Appendix Section C.1).

Alternative Productivity Measures. Second, our findings are robust to alternative definitions of firm-level productivity. In addition to our baseline labor productivity measure, we recompute key patterns using Total Factor Productivity. These variants produce consistent patterns on stagnation, selection, and misallocation (Appendix Section C.2).

Validation Against ORBIS. Third, our analysis spans a period of considerable political and economic upheaval in Ukraine, which may affect the completeness and quality of firm-level data, particularly for young and small firms. These concerns are especially acute in commercial datasets such as ORBIS, where data from more recent years, particularly after 2009, lack reliable firm age information, precluding life-cycle and entry analyses (Figure A5). In earlier years, when firm age information is more complete, the ORBIS dataset exhibits a clear bias toward older firms and systematically underrepresents younger cohorts, as illustrated in Figure A6. In contrast, our use of administrative data with near-universal coverage significantly mitigates these limitations. As illustrated in Appendix C.3, our dataset, based on official administrative sources, provides substantially greater consistency and coverage over time compared to ORBIS.

Although the limited availability of firm age information prevents us from replicating life-cycle profiles, entry rates, and the employment share of young firms, ORBIS can still be used to examine certain moments that are less sensitive to missing age information. In particular, productivity growth over time, the relationship between firm size and productivity, and the responsiveness of employment to productivity shocks can still be credibly examined using this dataset. We replicate these three core moments using ORBIS in Figures A7 and A8, and Table A4 and find that the patterns closely align with those estimated from our administrative data. This external validation further strengthens the empirical credibility of our findings and underscores the robustness of our key conclusions.

Structural Estimation Moments. Fourth, we test the robustness of our structural estimation to the choice of targeted moments. In the baseline specification, we target the correlation between firm size and productivity to discipline the extent of institutional capture. As a robustness check, we re-estimate the model adding the empirical correlation between FDI and new firm entry in

addition. The resulting parameter estimates and policy implications remain highly consistent (see Appendix C.4).

Alternative Estimation Window. Finally, we re-estimate the model using moments drawn from the pre-crisis period 2002-2007, instead of our baseline 2002-2013 window. While the shorter window captures a more dynamic phase of the economy, our key estimates remain stable, confirming the robustness of our quantitative conclusions to the time period used in estimation (Appendix Section C.5).

Taken together, these robustness checks reinforce the empirical validity and quantitative reliability of our findings.

6 Engineering Ukraine's *Wirtschaftswunder*

Business dynamism in Ukraine is on the decline with the economy dominated by entrenched market leaders. In this paper, we advance a framework to examine the priorities and sequence of reforms and find that reforms that discipline entrenched incumbents are most pressing for economic revitalization. These priorities mirror those of west Germany as that country embarked on its *Wirtschaftswunder* or economic miracle of the 1950s. Dismantling wartime industrial cartels and promoting competition formed the bedrock of German economic policies.

Ukrainian policymakers will need to discipline incumbent institutions and individuals (including large firms, SOEs, and outdated political arrangements) by fostering competition regimes that encourage new entrants without unduly favoring or disfavoring existing businesses, reforming outdated institutional arrangements that protect incumbents and hinder innovation, addressing institutional inertia that reinforces the status quo and makes it difficult to adapt to changing economic conditions, and promoting transparency and accountability within both the public and private sectors.

Our analysis shows that SOEs are significantly less productive, yet their market share has continued to grow, underscoring the potential role of privatization in Ukraine. Its impact on market concentration and business dynamism, however, depends critically on design and implementation. When assets are transferred to a narrow set of incumbents or politically connected buyers, privatization can entrench dominant firms, restrict entry, and stifle innovation. The experience of East Germany following reunification provides a cautionary contrast to the postwar reforms of West Germany: under political pressure to accelerate privatization ahead of the 1994 elections, the process was significantly captured by West German firms, which crowded out local entrepreneurship and reinforced regional economic disparities (Akcigit et al., 2023a, 2025a). Rather than catalyzing broad-based renewal, this approach led to consolidation and persistent

structural imbalances. These lessons highlight the need for competitive, transparent privatization anchored in strong institutional frameworks to avoid outcomes that undermine long-run productivity growth.

Our study also reveals that the origin of FDI plays a critical role in shaping domestic business dynamics. While the World Development Report (2024) highlights FDI as a potential channel for transferring frontier technologies and practices to host economies, our current findings suggest that this promise has not materialized in the Ukrainian context. Rather than fostering productivity or enhancing firm-level capabilities, such investment appears to be linked with patterns of entrenchment and reduced entry. This underscores the importance of not only attracting FDI, but also ensuring that its source and structure are conducive to long-run economic development.

Another policy currently under discussion is a capital amnesty program aimed at mobilizing offshore or undeclared domestic capital into productive, development-oriented investments. While post-war reconstruction creates opportunities for renewal, it also risks further entrenching powerful actors best positioned to benefit from recovery. Without firm action, these forces may block the creative destruction necessary for sustained growth. Ensuring that powerful incumbents are subject to clear rules and credible discipline, despite the political challenges of a post-war setting, will be critical for Ukraine's transition to a modern, dynamic economy.

Finally, as documented in the Draghi Report (Draghi, 2024), Europe faces a persistent shortfall in business dynamism, lagging behind the United States in productivity growth and entrepreneurial activity due to deep-rooted structural and institutional constraints. By pursuing a more ambitious reform path centered on competition, innovation, and firm-level productivity, Ukraine has the potential to chart a different course. With the right policies, it could emerge not only as a postwar success story but also as a vital source of business dynamism for a continent in need of renewal, particularly in the era of transformative technologies like AI.

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Appendix

A Data

XXX WE NEED TO WRITE SOME DESCRIPTIONS FOR THE DATA SECTION AND REGIONAL LIFE CYCLE

Table A1: Comparison of Financial Statements Data with Official Aggregate Statistics

Number of Firms (Manufacturing)			
Year	FRD Data	Official Statistics	FRD Data / Official (%)
2002	38,583	47,072	81.97%
2003	45,415	48,740	93.18%
2004	45,413	49,594	91.57%
2005	45,490	50,487	90.10%
2006	45,005	50,038	89.94%
2007	45,245	49,886	90.70%
2008	42,579	Not reported	N/A
2009	44,170	Not reported	N/A
2010	38,116	41,218	92.47%
2011	38,478	40,713	94.51%
2012	38,388	36,767	104.41%
2013	39,610	41,399	95.68%
2014	34,320	35,878	95.66%
2015	33,853	36,000	94.04%
2016	30,956	32,435	95.44%
2017	33,036	35,197	93.86%
2018	34,923	36,862	94.74%
2019	34,136	38,775	88.04%
2020	21,356	39,057	54.68%
2021	21,948	40,080	54.76%
2022	31,104	29,680	104.80%
2023	34,443	33,887	101.64%

Note: Official statistics refer to publicly available employment aggregates from the State Statistics Service of Ukraine (<https://www.ukrstat.gov.ua/>). Data on the number of firms by sector was not reported in 2008 and 2009.

Table A2: Comparison of Financial Statements Data with Official Aggregate Statistics

Employment (Manufacturing)			
Year	FRD Data	Official Statistics	FRD Data / Official (%)
2002	2,896,225	Not reported	N/A
2003	2,760,872	Not reported	N/A
2004	2,727,522	2,786,900	97.87%
2005	2,724,165	2,775,500	99.39%
2006	2,686,477	2,741,000	98.01%
2007	2,564,376	2,607,900	98.33%
2008	2,402,060	2,448,000	98.12%
2009	2,096,401	2,123,700	98.71%
2010	1,976,605	1,972,775	100.19%
2011	1,955,878	1,956,716	99.96%
2012	1,949,726	1,950,399	99.97%
2013	1,830,515	1,863,520	98.23%
2014	1,597,884	1,610,991	99.19%
2015	1,469,448	1,470,634	99.92%
2016	1,413,193	1,422,291	99.36%
2017	1,420,376	1,437,105	98.84%
2018	1,439,877	1,442,092	99.85%
2019	1,383,413	1,396,962	99.03%
2020	623,449	1,362,361	45.76%
2021	935,647	1,345,842	69.52%
2022	1,059,992	1,114,189	95.14%
2023	996,883	999,189	99.77%

Note: Official statistics refer to publicly available employment aggregates from the State Statistics Service of Ukraine (<https://www.ukrstat.gov.ua/>). Employment data by sector was not systematically reported in 2002 and 2003.

B Theory Appendix

In this appendix section, we outline derivations of the BGP equilibrium that are skipped in the main text and provide the proof of Proposition 1. In subsection B.1, we outline how we derive targeted moments from the model.

Aggregate demand. We normalize the price of the final good to one in each period. Perfectly competitive final good producers solve the following profit maximization problem

$$\max_{\{y_{jt}\}_{j=0}^1} \exp \left[\int_0^1 \ln y_{jt} dj \right] - \int_0^1 p_{jt} y_{jt} dj$$

where p_{jt} is the price of the intermediate variety j taken as given by final good producers. First-order condition to this maximization problem yields the unit elastic demand schedule for each

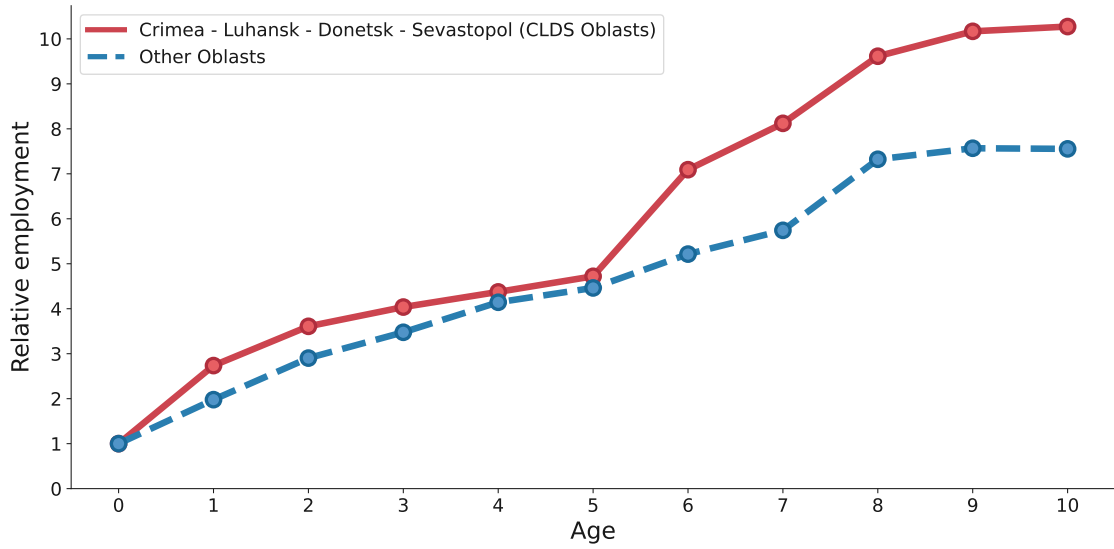


Figure A1: Occupied regions historically had higher business dynamism compared to other Ukrainian regions

Notes: The figure plots the firm life cycle profiles for two regions in Ukraine: (i) war-affected regions, i.e. CLDS oblasts, that include Crimea, Luhansk, Donetsk, and Sevastopol, and (ii) the rest of the country. Life cycle profiles are calculated for the years between 2002 and 2013. Relative employment of a region $\times$ age bin equals the ratio of average employment of firms belonging to the bin to the average employment of zero-year old cohorts in the same region.

variety j :

$$\exp \left[\int_0^1 \ln y_{jt} dj \right] \frac{1}{y_{jt}} = p_{jt} \implies p_{jt} y_{jt} = Y_t, \quad \forall j \in [0, 1]$$

Representative household. The model economy admits a representative household who consumes the final good and earns labor income. They maximize their life-time utility subject to budget constraint:

$$\begin{aligned} & \max_{\{C_t\}_{t=0}^{\infty}} \int_0^{\infty} e^{-\rho t} \ln C_t dt \\ & \text{s.t. } \dot{\mathcal{A}}_t = r_t \mathcal{A}_t + W_t L + \bar{\Pi}_t - C_t \end{aligned}$$

where $\bar{\Pi}_t = \int_0^1 \Pi_{jt} dj$ is the sum of profits accrued to households from all the firms in the economy, W_t is the wage rate, $\mathcal{A}_t = \int_0^1 V_{jt} dj$ is the sum of market value of all the firms in the economy. Finally, r_t denotes the real interest rate, and ρ is the time discount rate.

First-order condition to this maximization problem yields the standard Euler equation:

$$g_t = r_t - \rho, \tag{A1}$$

where the growth rate of the economy is denoted by $g_t \equiv \frac{\dot{Y}_t}{Y_t}$. Final good used only for consumption of the representative household, i.e. $Y_t = C_t$. Therefore, g_t also equals the growth rate of consumption.

Balanced growth path equilibrium. In this stationary equilibrium, interest rate r_t , growth rate g_t and creative destruction rate τ_t are time invariant, and they are denoted by r , g and τ , respectively. Furthermore, the growth rate of wages and output are same, hence $\frac{W_t}{Y_t}$ is constant and denoted by ω . Having outlined the characteristics of a BGP equilibrium, we can now proceed with the proof of Proposition 1.

Proof of Proposition 1. Recall the Hamilton-Jacobi-Bellman equation (4) from the main text:

$$rV_{n,m} - \dot{V}_{n,m} = \max_X \left\{ n\pi Y_t - \frac{1}{\theta}(n+m) \left(\frac{X}{n+m} \right)^\eta W_t + X(V_{n+1,m} - V_{n,m}) \right. \\ \left. + \tau n(V_{n-1,m} - V_{n,m}) + \tau m(V_{n,m-1} - V_{n,m}) + \delta n(V_{n-1,m+1} - V_{n,m}) \right\}.$$

Note that the value function $V_{n,m}$ is also a function of time. The term $\dot{V}_{n,m}$ denotes the time derivative of $V_{n,m}$. First-order condition to this maximization program is given by

$$\frac{\eta}{\theta} \left(\frac{X_t}{n+m} \right)^{\eta-1} W_t = V_{n+1,m} - V_{n,m}.$$

Define the per product line rate of innovation as $x_t \equiv \frac{X_t}{n+m}$ as in the main text. Then

$$\frac{\eta}{\theta} x_t^{\eta-1} W_t = V_{n+1,m} - V_{n,m}.$$

We conjecture that the value function $V_{n,m}$ has the form

$$V_{n,m} = n \cdot v^f \cdot Y_t + m \cdot v^c \cdot Y_t$$

as in Proposition 1. Replacing the conjecture into first-order condition yields

$$\frac{\eta}{\theta} x_t^{\eta-1} W_t = v^f Y_t$$

Recall that $\omega = \frac{W_t}{Y_t}$ is constant in a BGP equilibrium. Thus, $x_t = x$ for all t in BGP, and it satisfies

$$\frac{\eta}{\theta} x^{\eta-1} \omega = v^f \implies x = \left(\frac{\theta v^f}{\eta \omega} \right)^{\frac{1}{\eta-1}} \quad (\text{A2})$$

as claimed in equation (5) in the main text.

Our conjecture allows us to evaluate the time-derivative term as follows

$$\dot{V}_{n,m} = n v^f g Y_t + m v^c g Y_t,$$

where g is the constant growth rate of Y_t . Replacing this expression and the conjecture into the

HJB equation and dividing both sides by Y_t yields the following equation:

$$\begin{aligned} rnv^f + rmv^c - gnv^f - gmv^c = & n\pi - \frac{1}{\theta}nx^\eta\omega - \frac{1}{\theta}mx^\eta\omega \\ & + xnv^f + xmv^f - \tau nv^f - \tau mv^c + \delta n(v^c - v^f) \end{aligned} \quad (A3)$$

In order to solve for v^f and v^c , we split this equation into two parts: first part with terms n and second part with terms m as follows

$$(r - g)nv^f = n\pi - \frac{1}{\theta}nx^\eta\omega + xnv^f - \tau nv^f + \delta n(v^c - v^f) \quad (A4)$$

$$(r - g)mv^c = -\frac{1}{\theta}mx^\eta\omega + xmv^f - \tau mv^c. \quad (A5)$$

In other words, equations (A4) and (A5) together imply the equation (A3). Therefore, any solution of v^f and v^c for the system given by (A4) and (A5) also satisfies the equation (A3).

We now simplify equations (A4) and (A5) by first dividing their both sides to n and m respectively, and using the relationship $xv^f - \frac{1}{\theta}x^\eta\omega = \frac{\eta-1}{\theta}x^\eta\omega$, which can be obtained from (A2). We derive

$$(r - g + \tau)v^f = \pi + \frac{\eta-1}{\theta}x^\eta\omega - \delta(v^f - v^c) \quad (A6)$$

$$(r - g + \tau)v^c = \frac{\eta-1}{\theta}x^\eta\omega. \quad (A7)$$

This system of equations are equivalent to the one given by Proposition 1 with the help of the relationship $xv^f - \frac{1}{\theta}x^\eta\omega = \frac{\eta-1}{\theta}x^\eta\omega$. Equation (A7) directly implies the solution for v^c given by equation (6). Finally, replacing the expression for v^c into (A6) yields the solution for v^f as given by equation (7) in the main text. This completes the proof and the derivations of the value functions. ■

Firm size distribution for H -types. Denote by $F_H(k, t)$ the mass of H -type firms with a total of $k = n + m$ products at time t . We derive the Kolmogorov-Forward equations for the evolution of this mass as a result of innovation decisions and creative destruction.

$$\dot{F}_H(k, t) = \underbrace{F_H(k-1, t)(k-1)x_t + F_H(k+1, t)(k+1)\tau_t}_{\text{inflow}} - \underbrace{F_H(k, t)k(x_t + \tau_t)}_{\text{outflow}}, \quad \text{for } k = 2, 3, \dots \quad (A8)$$

First two terms in the right-hand side of equation (A8) represents to the inflows to state k . Firms with $k-1$ products can innovate with rate $(k-1)x_t$ and increase their product portfolio by one and transition into the state k . Given that the total mass of such firms is $F_H(k-1, t)$, a mass of $F_H(k-1, t)(k-1)x_t$ firms experience this event. Similarly, firms with $k+1$ products lose one of their products due to creative destruction with rate $(k+1)\tau_t$. In total, $F_H(k+1, t)(k+1)\tau_t$ many of them will transition from $k+1$ to k . The outflow from state k comprises a single term. All firms with k products are subject to either innovation with rate kx_t , which transitions them from k to $k+1$, or creative destruction with rate $k\tau_t$, which transitions them from k to $k-1$. A total mass of $F_H(k, t)k(x_t + \tau_t)$ represents the outflows from the state k . Equation (A8) holds for only

states $k = 2, 3, \dots$

Similarly, we can derive the law of motion for $k = 1$, i.e. $F_H(1, t)$ as follows

$$\dot{F}_H(1, t) = \underbrace{p_H \tilde{x}_t + F_H(2, t) 2\tau_t}_{\text{inflow}} - \underbrace{F_H(1, t)(x_t + \tau_t)}_{\text{outflow}}. \quad (\text{A9})$$

The only difference between equations (A8) and (A9) stems from the first term of inflows. That is, the entry rate into the state $k = 1$ equals $p_H \tilde{x}_t$. As the total mass of potential entrants equals to one, the total flow equals the rate $p_H \tilde{x}_t$. Note that $\tilde{x}_t$ is multiplied by p_H because p_H is the probability of entering as a H -type.

In BGP equilibrium, $\dot{F}(k, t) = 0$ for all $k = 1, 2, \dots$ and t , and $x_t = x$, $\tilde{x}_t = \tilde{x}$ and $\tau_t = \tau$. Under this environment, solution to the Kolmogorov-Forward equations (A8) and (A9) is denoted by $F_H(k)$ and given by

$$F_H(k) = \frac{p_H \tilde{x}}{x} \frac{(x/\tau)^k}{k}. \quad (\text{A10})$$

Let $\bar{F}_H$ denote the total mass of H -type firms. It is equal to

$$\bar{F}_H := \sum_{k=1}^{\infty} F_H(k) = \frac{p_H \tilde{x}}{x} \ln \left(\frac{\tau}{\tau - x} \right). \quad (\text{A11})$$

Furthermore, the mass of product lines owned by H -type firms, M_H , is equal to

$$\begin{aligned} M_H &= \sum_{k=1}^{\infty} k F_H(k) = \sum_{k=1}^{\infty} k \frac{p_H \tilde{x}}{x} \frac{(x/\tau)^k}{k} \\ &= \frac{p_H \tilde{x}}{x} \frac{x}{\tau} \left(1 + \frac{x}{\tau} + \left(\frac{x}{\tau} \right)^2 + \dots \right) \\ &= \frac{p_H \tilde{x}}{\tau} \frac{1}{1 - \frac{x}{\tau}} \\ &= \frac{p_H \tilde{x}}{\tau - x}, \end{aligned}$$

under the condition $x < \tau$. This expression is equivalent to M_H in the main text.

Firm size distribution for L -types. L -type firms do not innovate. Let $F_L(k, t)$ denote the mass of L -type firms with a total of $k = n + m$ products. For $k = 2, 3, \dots$, we simply have $F_L(k, t) = 0$. For $k = 1$, we derive the following Kolmogorov-Forward equation similar to equation (A9):

$$\dot{F}_L(1, t) = \underbrace{p_L \tilde{x}_t}_{\text{inflow}} - \underbrace{F_L(1, t) \tau_t}_{\text{outflow}}$$

In BGP, $\dot{F}_L(1, t) = 0$, $\tilde{x}_t = \tilde{x}$ and $\tau_t = \tau$. Thus,

$$F_L(k) = \begin{cases} \frac{p_L \tilde{x}}{\tau} & \text{if } k = 1 \\ 0 & \text{if } k = 2, 3, \dots \end{cases} \quad (\text{A12})$$

Total mass of L -type incumbent firms equals $\bar{F}_L = F_L(1) = \frac{p_L \tilde{x}}{\tau}$. This quantity also equals to the mass of product lines owned by L -type firms.

Creative destruction rate in equilibrium. Creative destruction rate per-line τ equals the sum of innovation flows divided by the mass of all product lines which is normalized to one. Total innovation flow in this economy is generated by either entrants or H -type incumbents. As the mass of potential entrants equals one and their innovation rate $\tilde{x}$, creative destruction rate due to entry equals $\tilde{x}$. As the per-line innovation rate of H -type equals x and they own a mass of M_H products, total creative destruction rate due to H -type innovation equals $M_H x$. Sum of these equals τ :

$$\tau = \tilde{x} + M_H x = \tilde{x} + \frac{p_H \tilde{x}}{\tau - x} x \quad (\text{A13})$$

which defines a quadratic equation in τ as a function of x and $\tilde{x}$. We can show that both roots are positive provided that $x > 0$ and $\tilde{x} > 0$. Furthermore, the largest root equals

$$\tau = \frac{x + \tilde{x} + \sqrt{(x + \tilde{x})^2 - 4p_L x \tilde{x}}}{2}$$

B.1 Targeted Moments from the Model

We target five moments where we list them below

1. Growth rate
2. Average size of 10-year-old firms relative to entrants
3. Firm entry rate
4. Average share of small firms in the cohort of 5-year-olds relative to that in the entering cohort
5. Correlation between firm labor productivity and size

We start with firm life cycle profile for the second moment, as the growth rate is already derived in the main text as $g = \tau \ln \lambda$.

B.1.1 Firm Life Cycle Profile

Firm life cycle, including H and L -type firms, is given by the object $E[K \mid A = a, K \neq 0]$ which defines the expected size of the firm (K) measured as the number of products owned by the firm conditional on age $A = a$ and survival ($K \neq 0$). We have

$$E[K \mid A = a, K \neq 0] = \sum_{k=1}^{\infty} k P(K = k \mid A = a, K \neq 0) \quad (\text{A14})$$

We define the probability $P(K = k \mid A = a, K \neq 0)$ to calculate this expectation. It is the probability of being size k conditional on age a and survival. This probability distribution is

defined over $k = 1, 2, \dots$. Using Bayes' rule, we can write

$$P(K = k | A = a, K \neq 0) = P(K = k | A = a, K \neq 0, T = H) \cdot P(T = H | A = a, K \neq 0) \\ + P(K = k | A = a, K \neq 0, T = L) \cdot P(T = L | A = a, K \neq 0), \quad (\text{A15})$$

where T denotes the type of the firm $T = H$ or L . Now we derive all these four terms in (A15).

First term in (A15). Start with $P(K = k | A = a, K \neq 0, T = H)$ for $k = 1, 2, \dots$. We have

$$P(K = k | A = a, K \neq 0, T = H) = \frac{P(K = k | A = a, T = H)}{P(K \neq 0 | A = a, T = H)}, \quad k = 1, 2, \dots$$

Here the new probability object $P(K = k | A = a, T = H)$, the probability of size (including exit as we do not condition on survival anymore) conditional on age and type, comes from the following system of differential equations:

$$\begin{aligned} \dot{P}(K = k | A = a, T = H) = & P(K = k - 1 | A = a, T = H)(k - 1)x \\ & + P(K = k + 1 | A = a, T = H)(k + 1)\tau \\ & - P(K = k | A = a, T = H)k(x + \tau), \quad \text{for } k = 1, 2, 3, \dots \end{aligned}$$

and for $k = 0$, we have

$$\dot{P}(K = 0 | A = a, T = H) = P(K = 1 | A = a, T = H)\tau$$

As Klette and Kortum (2004) shows, this system admits the following solution in BGP:

$$P(K = 0 | A = a, T = H) = \frac{\tau [1 - e^{-(\tau-x)a}]}{\tau - xe^{-(\tau-x)a}} \quad (\text{A16})$$

$$P(K = 1 | A = a, T = H) = \left[1 - P(K = 0 | A = a, T = H)\right] (1 - \gamma(a)) \quad (\text{A17})$$

$$P(K = k | A = a, T = H) = P(K = k - 1 | A = a, T = H)\gamma(a), \quad \text{for } k = 2, 3, \dots \quad (\text{A18})$$

where

$$\gamma(a) = \frac{x [1 - e^{-(\tau-x)a}]}{\tau - xe^{-(\tau-x)a}} \quad (\text{A19})$$

We can construct the first term using this solution as follows:

$$P(K = k | A = a, K \neq 0, T = H) = [1 - \gamma(a)] \gamma(a)^{k-1}, \quad k = 1, 2, \dots \quad (\text{A20})$$

Third term in (A15). Knowing that $x = 0$ for low types, and using equations above or simple intuition, we can show

$$P(K = k | A = a, K \neq 0, T = L) = \frac{P(K = k | A = a, T = L)}{P(K \neq 0 | A = a, T = L)} = \begin{cases} 1 & \text{for } k = 1 \\ 0 & \text{for } k = 2, 3, \dots \end{cases} \quad (\text{A21})$$

That is, conditional on survival, there is only one possibility for low types, i.e. $k = 1$, independent of age.

Second and forth terms in (A15). Forth term equals one minus the second term. Using Bayes' rule, second term can be written as

$$P(T = H \mid A = a, K \neq 0) = P(K \neq 0 \mid T = H, A = a) \frac{P(T = H \mid A = a)}{P(K \neq 0 \mid A = a)}$$

Note that, the type of the firm is determined at the entry and it never changes. Therefore, $P(T = H \mid A = a) = P(T = H \mid A = 0) = p_H$. For the denominator, we can use Bayes' rule

$$P(K \neq 0 \mid A = a) = P(K \neq 0 \mid A = a, T = H)P(T = H \mid A = a) + P(K \neq 0 \mid A = a, T = L)P(T = L \mid A = a)$$

Because we have $P(T = H \mid A = a) = p_H$ and $P(T = L \mid A = a) = p_L$, we can write

$$P(K \neq 0 \mid A = a) = p_H P(K \neq 0 \mid A = a, T = H) + p_L P(K \neq 0 \mid A = a, T = L)$$

Combining altogether, we have

$$P(T = H \mid A = a, K \neq 0) = \frac{p_H P(K \neq 0 \mid A = a, T = H)}{p_H P(K \neq 0 \mid A = a, T = H) + p_L P(K \neq 0 \mid A = a, T = L)} \in [0, 1]$$

The probability $P(K \neq 0 \mid A = a, T) = 1 - P(K = 0 \mid A = a, T)$ can be easily calculated from equation (A16). In particular, we show

$$P(K \neq 0 \mid A = a, T = H) = \frac{(\tau - x)e^{-(\tau - x)a}}{\tau - xe^{-(\tau - x)a}}$$

$$P(K \neq 0 \mid A = a, T = L) = e^{-\tau a},$$

where the last equality follows from the fact that $x = 0$ for L -types. Therefore we have

$$P(T = H \mid A = a, K \neq 0) = \frac{p_H \frac{(\tau - x)e^{-(\tau - x)a}}{\tau - xe^{-(\tau - x)a}}}{p_H \frac{(\tau - x)e^{-(\tau - x)a}}{\tau - xe^{-(\tau - x)a}} + p_L e^{-\tau a}} \quad (\text{A22})$$

$$P(T = L \mid A = a, K \neq 0) = \frac{p_L e^{-\tau a}}{p_H \frac{(\tau - x)e^{-(\tau - x)a}}{\tau - xe^{-(\tau - x)a}} + p_L e^{-\tau a}} \quad (\text{A23})$$

Back to life cycle in (A14). Substituting equations (A20) and (A22) in equation (A15) and further solving the summation in (A14), we derive

$$E[K \mid A = a, K \neq 0] = \left[\sum_{k=1}^{\infty} k [1 - \gamma(a)] \gamma(a)^{k-1} \right] P(T = H \mid A = a, K \neq 0) + P(T = L \mid A = a, K \neq 0)$$

$$= \frac{1}{1 - \gamma(a)} P(T = H \mid A = a, K \neq 0) + P(T = L \mid A = a, K \neq 0) \quad (\text{A24})$$

where probabilities $P(T = H \mid A = a, K \neq 0)$ and $P(T = L \mid A = a, K \neq 0)$ are given by (A22) and (A23), respectively, and $\gamma(a)$ is given by (A19).

Note that $E[K \mid A = 0, K \neq 0] = 1$. This follows from the fact that firms enter with a single product line.¹⁴ Therefore, we directly match the model-generated moment $E[K \mid A = 10, K \neq 0]$, the expected size of 10-year-old firms conditional on survival, to its empirical counterpart, which is the average size of 10-year-old firms relative to entrants.¹⁵

B.1.2 Share of Small Firms by Age

Small firms, including H and L -type firms, are defined as firms with a single product in the model ($k = 1$). Therefore, we want to derive $P(K = 1 \mid A = a, K \neq 0)$. By the law of large numbers, this probability also equals to the share of a -year-old firms with one product in the cohort of a -year-olds. Using equation (A15) and its derivation in the previous subsection, we show:

$$P(K = 1 \mid A = a, K \neq 0) = [1 - \gamma(a)] P(T = H \mid A = a, K \neq 0) + P(T = L \mid A = a, K \neq 0), \quad (\text{A25})$$

where probabilities $P(T = H \mid A = a, K \neq 0)$ and $P(T = L \mid A = a, K \neq 0)$ are given by (A22) and (A23), respectively, and $\gamma(a)$ is given by (A19).

Note that, as all entrants are small by definition ($k = 1$ for them), we have $P(K = 1 \mid A = 0, K \neq 0) = 1$. Therefore, when estimating the model, we match the model generated moment $P(K = 1 \mid A = 5, K \neq 0)$ to its empirical counterpart, i.e. the share of small firms in the cohort of 5-year-olds relative to that in the entering cohort. We define the small firms in the data as firms with employment less than or equal to four.

B.1.3 Entry rate

Firm entry rate in the model is equal to total entry flow divided by the total number of firms in the economy. Total entry flow equals $\tilde{x}$. That is, in every moment, $\tilde{x}$ many firms are created. Total number of incumbent firms of different types, including entrenched firms, is equal

$$\begin{aligned} \text{High types} &\rightarrow \bar{F}_H = \sum_{k=1}^{\infty} F_H(k) = \frac{p_H \tilde{x}}{x} \ln \left(\frac{\tau}{\tau - x} \right) \\ \text{Low types} &\rightarrow \bar{F}_L = \sum_{k=1}^{\infty} F_L(k) = \frac{p_L \tilde{x}}{\tau} \\ \text{Entrenched firms or product lines} &\rightarrow M_E = \frac{\delta}{\tau + \delta} \end{aligned}$$

Therefore, the firm entry rate is equal

$$\text{entry rate} = \frac{\tilde{x}}{\bar{F}_H + \bar{F}_L + M_E} = \frac{\tilde{x}}{\frac{p_H \tilde{x}}{x} \ln \left(\frac{\tau}{\tau - x} \right) + \frac{p_L \tilde{x}}{\tau} + \frac{\delta}{\tau + \delta}}. \quad (\text{A26})$$

¹⁴We can also evaluate the life cycle function (A24) for $a = 0$.

¹⁵As we take the time period in the model as one year, we can interpret the age in the model as the number of years the firm has survived. Therefore, we set $a = 10$.

B.1.4 Correlation between firm labor productivity and size

Our correlation measure captures the within sector (product line) productivity and size correlation. In captured product lines, resources are misallocated between two competitive firms and a third entrenched firm.

For any two random variables X and Y , correlation coefficient equals

$$\rho = \frac{Cov[X, Y]}{\sqrt{Var[X]}\sqrt{Var[Y]}} = \frac{E[(X - E[X])(Y - E[Y])]}{\sqrt{E[(X - E[X])^2]}\sqrt{E[(Y - E[Y])^2]}}$$

Here, X is the log labor productivity of the firm and Y is the firm's production employment. There are three expectation terms in this expression. We derive these terms firstly within product lines, and then aggregate them across product lines based on measures of captured vs fair product lines, i.e. M_E and $1 - M_E$, respectively. When we calculate the productivity – size correlation, we allow for entrenchment size to vary, denoting it with $N \geq 1$. That is, entrenched firms are N steps behind the frontier. When they capture the product line, the product is produced at an efficiency level of λ^{-N} times the frontier productivity level.

The model implies that the amount of production workers used in each product line is the same across product lines. We denote production workers employed with L_p .

Covariance between productivity and labor in fair product lines. In fair product lines, entrenched firm is not active, and the production is carried out by the frontier firm whose productivity is the highest. Resources are allocated between competitive frontier and laggard firms. Covariance within a sector is calculated as the average deviations from the mean.

$$\begin{aligned} & \frac{1}{2} \left[\underbrace{\ln \lambda^{-1} a_j}_{\text{second firm's prod.}} - \underbrace{\frac{1}{2} (\ln \lambda^{-1} a_j + \ln a_j)}_{\text{avg. prod.}} \right] \left[\underbrace{0}_{\text{second firm's emp.}} - \underbrace{\frac{1}{2} (0 + L_p)}_{\text{avg. emp.}} \right] \\ & + \frac{1}{2} \left[\underbrace{\ln a_j}_{\text{frontier firm's prod.}} - \underbrace{\frac{1}{2} (\ln \lambda^{-1} a_j + \ln a_j)}_{\text{avg. prod.}} \right] \left[\underbrace{L_p}_{\text{frontier firm's emp.}} - \underbrace{\frac{1}{2} (0 + L_p)}_{\text{avg. emp.}} \right] \\ & = \frac{1}{4} L_p \ln \lambda \end{aligned}$$

Covariance between productivity and labor in captured product lines. In entrenched product lines, entrenched firm becomes active. Therefore, resources are allocated across three firms.

Production is carried out by the entrenched firm although its productivity is not the highest.

$$\begin{aligned}
& \frac{1}{3} \left[\underbrace{\ln \lambda^{-N} a_j}_{\text{entrenched firm's prod.}} - \frac{1}{3} \underbrace{(\ln \lambda^{-N} a_j + \ln a_j + \ln \lambda^{-1} a_j)}_{\text{avg. prod.}} \right] \left[\underbrace{L_p}_{\text{entrenched firm's emp.}} - \frac{1}{3} \underbrace{(L_p + 0 + 0)}_{\text{avg. emp.}} \right] \\
& + \frac{1}{3} \left[\underbrace{\ln a_j}_{\text{frontier firm's prod.}} - \frac{1}{3} \underbrace{(\ln \lambda^{-N} a_j + \ln a_j + \ln \lambda^{-1} a_j)}_{\text{avg. prod.}} \right] \left[\underbrace{0}_{\text{frontier firm's emp.}} - \frac{1}{3} \underbrace{(L_p + 0 + 0)}_{\text{avg. emp.}} \right] \\
& + \frac{1}{3} \left[\underbrace{\ln \lambda^{-1} a_j}_{\text{second firm's prod.}} - \frac{1}{3} \underbrace{(\ln \lambda^{-N} a_j + \ln a_j + \ln \lambda^{-1} a_j)}_{\text{avg. prod.}} \right] \left[\underbrace{0}_{\text{second firm's emp.}} - \frac{1}{3} \underbrace{(L_p + 0 + 0)}_{\text{avg. emp.}} \right] \\
& = \frac{-2N+1}{9} L_p \ln \lambda
\end{aligned}$$

Numerator term $Cov[X, Y]$. Numerator term $Cov[X, Y]$ is then found as the average within product line covariance across all product lines. We integrate within covariances with respect to the measure of entrenched product lines M_E .

$$\begin{aligned}
Cov[X, Y] &= \underbrace{(1 - M_E)}_{\text{measure of fair sectors}} \cdot \underbrace{\frac{1}{4} L_p \ln \lambda}_{\text{cov. in fair sectors}} + \underbrace{M_E}_{\text{measure of entrenched sectors}} \cdot \underbrace{\left(\frac{-2N+1}{9} L_p \ln \lambda \right)}_{\text{cov. in entrenched sectors}} \\
&= \frac{9 - (5 + 8N)M_O}{36} L_p \ln \lambda
\end{aligned}$$

Variance of productivity in fair product lines. As before, fair sectors are populated by two competitive firms. Within product line variance of productivity across these two firms is calculated as

$$\begin{aligned}
& \frac{1}{2} \left[\underbrace{\ln \lambda^{-1} a_j}_{\text{second firm's prod.}} - \frac{1}{2} \underbrace{(\ln \lambda^{-1} a_j + \ln a_j)}_{\text{avg. prod.}} \right]^2 + \frac{1}{2} \left[\underbrace{\ln a_j}_{\text{frontier firm's prod.}} - \frac{1}{2} \underbrace{(\ln \lambda^{-1} a_j + \ln a_j)}_{\text{avg. prod.}} \right]^2 \\
& = \frac{1}{4} (\ln \lambda)^2
\end{aligned}$$

Variance of productivity in captured product lines. As before, entrenched sectors are populated by three firms: two competitive firms along with an entrenched firm. All factors are

allocated towards the entrenched firm in these sectors.

$$\begin{aligned}
& \frac{1}{3} \left[\underbrace{\ln \lambda^{-N} a_j}_{\text{ent. firm's prod.}} - \underbrace{\frac{1}{3} (\ln \lambda^{-N} a_j + \ln a_j + \ln \lambda^{-1} a_j)}_{\text{avg. prod.}} \right]^2 + \frac{1}{3} \left[\underbrace{\ln a_j}_{\text{frontier firm's prod.}} - \underbrace{\frac{1}{3} (\ln \lambda^{-N} a_j + \ln a_j + \ln \lambda^{-1} a_j)}_{\text{avg. prod.}} \right]^2 \\
& + \frac{1}{3} \left[\underbrace{\ln \lambda^{-1} a_j}_{\text{second firm's prod.}} - \underbrace{\frac{1}{3} (\ln \lambda^{-N} a_j + \ln a_j + \ln \lambda^{-1} a_j)}_{\text{avg. prod.}} \right]^2 \\
& = \frac{1}{9} (2N^2 - 2N + 2) (\ln \lambda)^2
\end{aligned}$$

Standard deviation of productivity $\sqrt{\text{Var}[X]}$:

$$\sqrt{\text{Var}[X]} = \sqrt{M_E \frac{1}{9} (2N^2 - 2N + 2) (\ln \lambda)^2 + (1 - M_E) \frac{1}{4} (\ln \lambda)^2} = \ln \lambda \sqrt{M_E \frac{1}{9} (2N^2 - 2N + 2) + (1 - M_E) \frac{1}{4}}$$

Variance of employment in fair product lines.

$$\begin{aligned}
& \frac{1}{2} \left[\underbrace{0}_{\text{second firm's emp.}} - \underbrace{\frac{1}{2} (0 + L_p)}_{\text{avg. emp.}} \right]^2 + \frac{1}{2} \left[\underbrace{L_p}_{\text{frontier firm's emp.}} - \underbrace{\frac{1}{2} (0 + L_p)}_{\text{avg. emp.}} \right]^2 \\
& = \frac{1}{4} L_p^2
\end{aligned}$$

Variance of employment in captured product lines.

$$\begin{aligned}
& \frac{1}{3} \left[\underbrace{L_p}_{\text{ent. firm's emp.}} - \underbrace{\frac{1}{3} (L_p + 0 + 0)}_{\text{avg. emp.}} \right]^2 + \frac{1}{3} \left[\underbrace{0}_{\text{frontier firm's emp.}} - \underbrace{\frac{1}{3} (L_p + 0 + 0)}_{\text{avg. emp.}} \right]^2 \\
& + \frac{1}{3} \left[\underbrace{0}_{\text{second firm's emp.}} - \underbrace{\frac{1}{3} (L_p + 0 + 0)}_{\text{avg. emp.}} \right]^2 \\
& = \frac{2}{9} L_p^2
\end{aligned}$$

Standard deviation of employment $\sqrt{\text{Var}[Y]}$.

$$\sqrt{\text{Var}[Y]} = \sqrt{M_E \frac{2}{9} L_p^2 + (1 - M_E) \frac{1}{4} L_p^2} = L_p \sqrt{M_E \frac{2}{9} + (1 - M_E) \frac{1}{4}}$$

Productivity – size correlation ρ . We now bring all the terms together

$$\rho = \frac{Cov[X, Y]}{\sqrt{Var[X]} \sqrt{Var[Y]}} = \frac{9 - (5 + 8N)M_E}{\sqrt{[4M_E(2N^2 - 2N + 2) + 9(1 - M_E)] [9 - M_E]}} \quad (A27)$$

Equation A27 represents the value of productivity – size correlation when the entrenchment size (in terms number of productivity steps) equals $N \geq 1$. We evaluate the correlation under $N = 1$.

C Empirical Robustness: Testing the Stability of Main Results

A natural concern when interpreting empirical findings is whether the observed patterns are artifacts of specific data choices, measurement error, or exceptional circumstances. In this section, we demonstrate the robustness of our main results to several alternative specifications and subsamples. First, we examine whether the trends we document are disproportionately driven by war-affected regions, excluding the four oblasts most directly impacted by the 2014 conflict. Second, we assess the sensitivity of our results to alternative definitions of productivity, re-estimating key moments using TFP rather than labor productivity. Third, we validate the consistency of our findings by comparing results based on our near-universe administrative dataset to those using the widely-used but limited ORBIS commercial database. Finally, we probe the robustness of our structural estimation by varying the targeted moments and the sample period. Across these exercises, we find that the core empirical and theoretical insights of the paper remain intact, strengthening our conclusion that the decline in business dynamism in Ukraine reflects structural and institutional forces rather than data limitations or transient shocks.

C.1 Exclusion of War-Affected Regions

One important question is how the war may have affected our results. To address this, we exclude the four regions most directly impacted by the 2014 Russian annexation and ensuing conflict, Crimea, Donetsk, Luhansk, and Sevastopol (henceforth, CLDS Oblasts). These regions account for roughly 20 percent of total employment and 13 percent of all firms in an average year between 2002 and 2019. As shown in Appendix Figure A2, all of our key empirical patterns, including the decline in productivity growth and resource reallocation, remain intact when these regions are excluded. This exercise confirms that our findings are not mechanically driven by war-affected territories, but reflect broader national trends.

Figure A2 presents the first set of results from this exercise. Panel A shows that average aggregate labor productivity growth, even after excluding CLDS, closely tracks the values in Figure 3 from the main text, including the downward trend over time. Panel B reports the Olley-Pakes covariance between labor productivity and employment, which rises until 2007, stabilizes during the crisis years, and declines after 2013, mirroring the pattern in Figure 6. Panels C and D illustrate the deterioration of firm dynamism in regions less directly affected by the conflict, reproducing the levels and trends found in Figures 4 and 5. Together, these results reinforce our conclusion that Ukraine’s decline in business dynamism predates and extends beyond the regions directly impacted by war.

Figure A3 presents additional measures of business dynamism and market concentration,

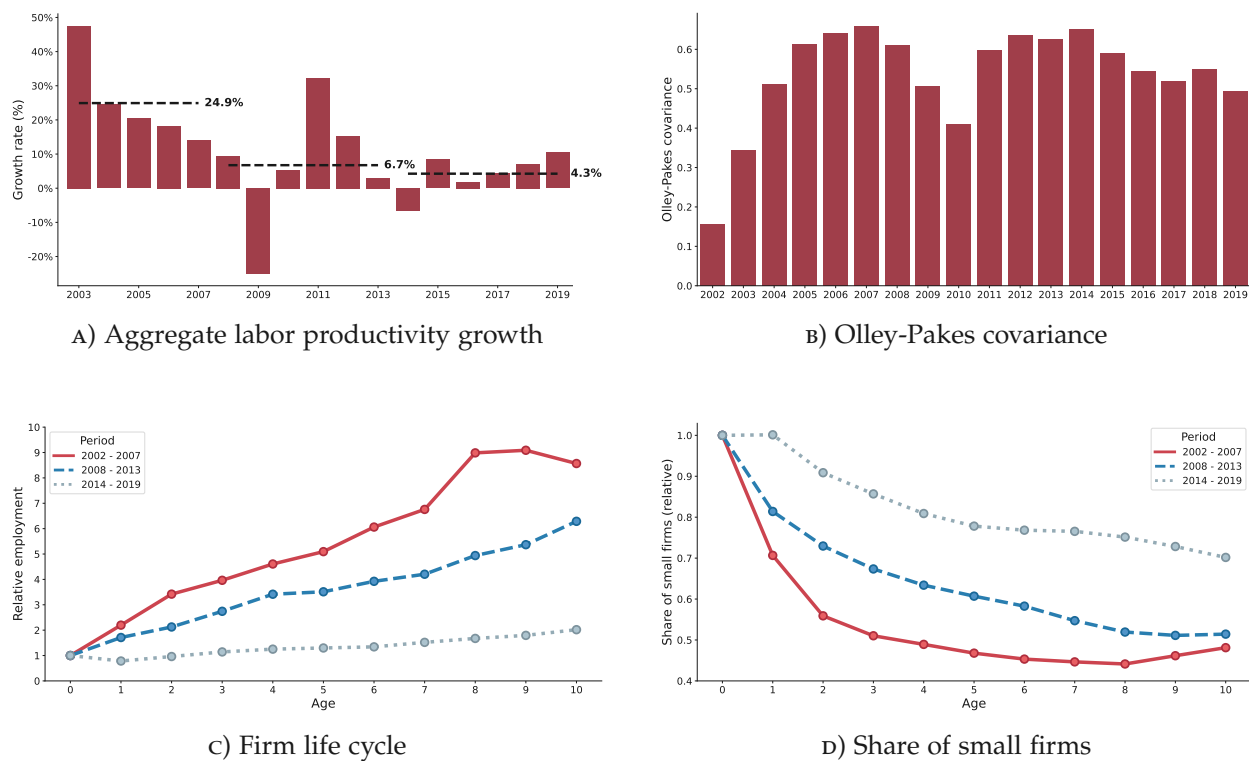


Figure A2: Excluding War-Affected Regions: Declining Dynamism and Selection, Rising Misallocation

Notes: All panels show aggregate statistics when war-affected four oblasts are excluded from the analysis. War-affected oblasts are Crimea, Luhansk, Donetsk and Sevastopol (CLDS oblasts). Panel A shows the annual growth rate of aggregate labor productivity of the manufacturing sector excluding firms from CLDS oblasts. Panel B shows the covariance term from the Olley-Pakes decomposition of aggregate productivity among firms from non-CLDS oblasts. Panel C plots the average life cycle of non-CLDS firms in terms of employment relative to the entering cohort. Finally, Panel D shows the share of small firms after excluding firms from CLDS. Small firm is defined as a firm with employment less than or equal to four. All four figures are re-created after filtering out the firms located in CLDS oblasts from FRD.

confirming the robustness of our findings to the exclusion of CLDS regions. As shown in Panels A and B, both firm entry rates and the employment share of young firms decline steadily from 2002 to 2019, mirroring the nationwide trends documented in the main text. These patterns hold even when focusing solely on regions less affected by the conflict. Panel C shows that market concentration in non-CLDS regions has followed an overall upward trajectory, consistent with our main findings, although there is a modest reversal after 2013. Overall, these results reinforce the conclusion that the decline in business dynamism and rise in concentration reflect broader national developments rather than being driven by war-affected territories.¹⁶

¹⁶In some countries, firms may engage in strategic splitting into smaller legal entities. If similar behavior occurs in Ukraine, our estimates of market concentration would represent a lower bound on the true degree of concentration.



Figure A3: Excluding War-Affected Regions: Declining Dynamism and Rising Concentration

Notes: All panels show aggregate statistics when war-affected four oblasts are excluded from the analysis. War-affected oblasts are Crimea, Luhansk, Donetsk and Sevastopol. Panel A shows average firm entry rate to manufacturing sector outside of CLDS. Panel B displays the average share of employment by young firms in 4-digit manufacturing industries in non-CLDS oblasts. A firm is defined as young firm if it is 5-years old or younger in a given year. Finally, Panel C plots the average share of sales by top 4 largest firms in 4-digit manufacturing industries outside of CLDS oblasts. All three figures are re-created after filtering out the firms located in CLDS oblasts from FRD.

C.2 Alternative Productivity Measures

To ensure that our findings are not driven by the choice of productivity metric, we re-estimate firm-level productivity using TFP rather than labor productivity, using the methodology of Akerberg et al. (2015). As shown in Figure A4, the pattern of aggregate productivity growth remains consistent: Ukrainian firms exhibited positive productivity growth in the early 2000s, but this momentum dissipated sharply after 2008. The decline is evident even when using TFP, confirming that the observed slowdown in productivity growth is robust to alternative productivity measures and not an artifact of using labor productivity alone.

In Table A3, we re-estimate the responsiveness of firm employment growth to productivity shocks using TFP instead of labor productivity. This alternative specification allows us to test whether our main findings are sensitive to how productivity is measured. As reported in the table, the estimated semi-elasticity of employment growth with respect to TFP shocks has declined significantly over time. The decline mirrors the patterns observed using labor productivity, reinforcing our conclusion that the reallocation of labor toward more productive firms has weakened.

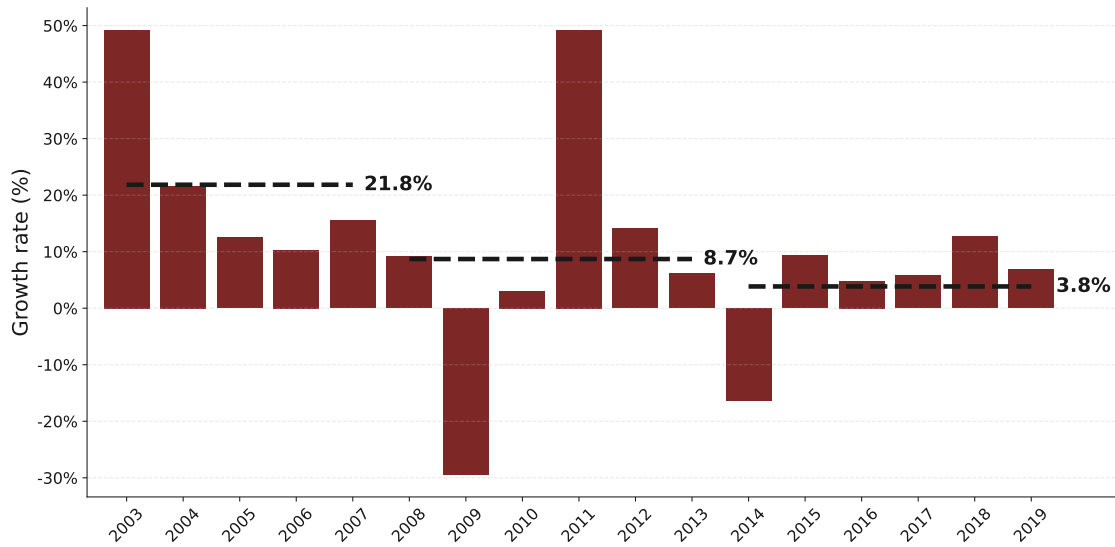


Figure A4: Aggregate TFP Growth

Notes: The figure plots the annual growth rate of aggregate TFP of the manufacturing sector. Firm level TFP is estimated by the methodology of Akerberg et al. (2015). Aggregate log TFP of a year $\times$ 4-digit sector pair is calculated as the weighted average of firm-level log TFPs belonging to the cell, weights being firm's employment share in the cell. Then, we take weighted average of 4-digit sector level aggregate log TFP across sectors in a year, weights being sector's employment share in the year. Aggregate TFP in a year equals the exponential of aggregate log TFP. Annual growth rate in year t is calculated as the percentage growth of aggregate TFP from year $t - 1$ to year t . Horizontal dashed black lines show average growth rates in three periods: 2002–2007, 2008–2013, and 2014–2019.

Table A3: Employment Responsiveness to TFP Shocks

	(1) All years	(2) 2002–2007	(3) 2008–2013	(4) 2014–2019
Log. TFP (t)	0.1049*** (0.001)	0.1275*** (0.001)	0.0956*** (0.001)	0.0771*** (0.001)
Log. Employment (t)	0.0094*** (0.001)	-0.0112*** (0.001)	0.0256*** (0.001)	0.0168*** (0.001)
Constant	-0.3685*** (0.002)	-0.2877*** (0.004)	-0.4435*** (0.004)	-0.3291*** (0.004)
Observations	393,877	151,521	141,763	100,593
R-squared	0.102	0.148	0.080	0.072
4-digit Sector $\times$ Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes

Notes: The table shows the OLS estimation of regression equation (1) where $\ln a_{it}$ equals the firm i 's log TFP, instead of log labor productivity. Dependent variable is firm's DHS employment growth rate from year t to year $t + 1$. Equation (1) is estimated for four different time periods separately. First column shows parameter estimates for all years between 2002 and 2019. Remaining columns are the results for periods 2002–2007, 2008–2013, and 2014–2019, respectively. Standard errors are in parentheses. Statistical significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

C.3 Validation Against ORBIS

XXX WE NEED TO WRITE EXPLANATIONS FOR THESE 4 FIGURES.

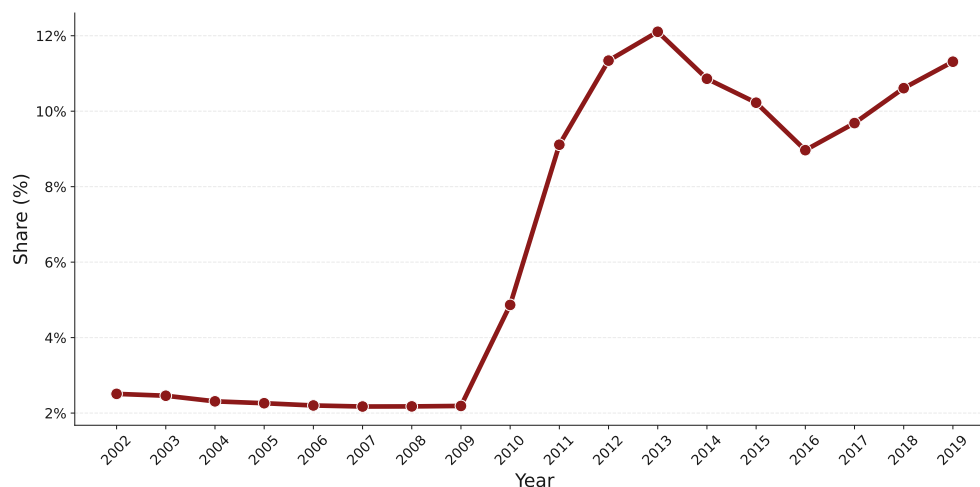


Figure A5: Share of Firm-Level Observations with Missing Age Information in ORBIS

Notes: The figure plots the share of firms with missing age information over years in ORBIS dataset. Birth date of a firm is defined as the incorporation date. If this date is later than the first year when the firm first appeared in the data, then firm's birth date is assumed to be missing. The same is assumed for the firms in FRD dataset.

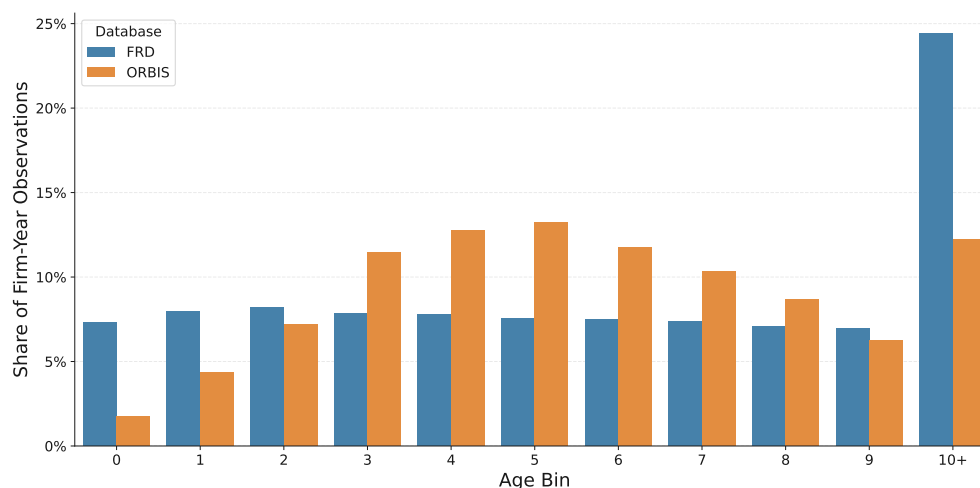


Figure A6: Age Distributions, FRD and ORBIS, 2002-2007

Notes: The bar chart compares two datasets, FRD and ORBIS, in terms of age distribution conditional on firms with non-missing age, between the years 2002 and 2007. Ages equal or greater than 10 are binned together. This distribution explicitly shows the difference in age coverage between FRD and ORBIS. While all age categories are represented as expected in FRD, ORBIS data misses young firms and entrants in this time period relative to our baseline dataset.

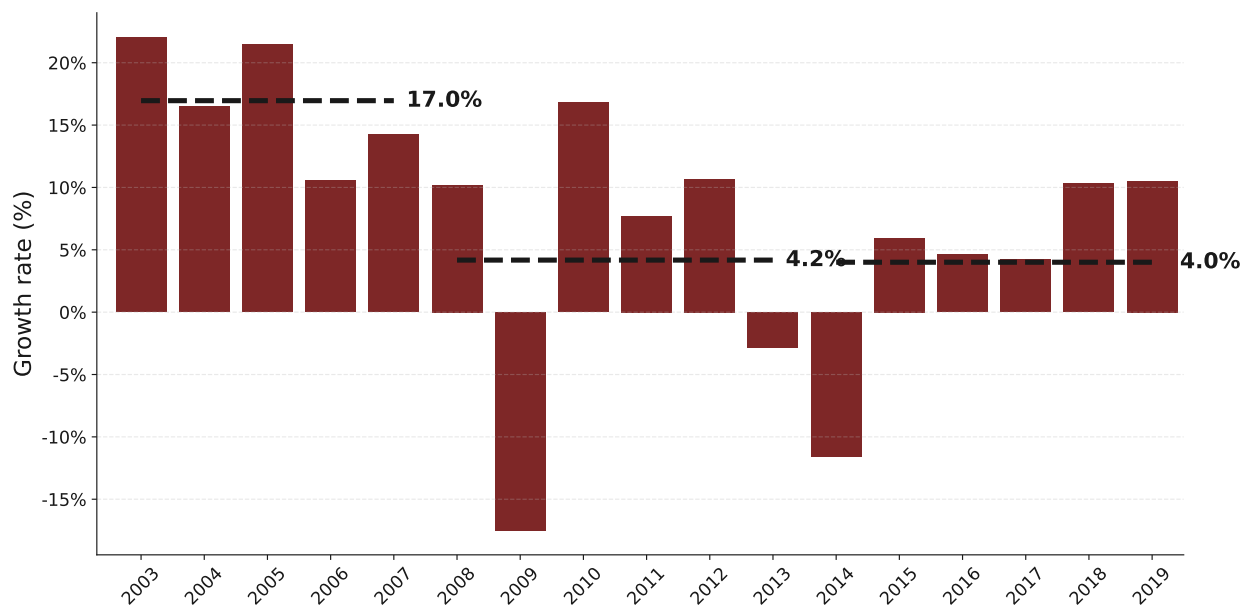


Figure A7: Labor Productivity Dynamics Based on ORBIS Data

Notes: The figure plots the annual growth rate of aggregate labor productivity of the manufacturing sector in ORBIS dataset. Firm level labor productivity equals real sales divided by employment, where nominal sales of the firm (sales column in ORBIS) is deflated by the 2-digit sector producer price index. Aggregate log labor productivity of a year $\times$ 4-digit sector pair is calculated as the weighted average of firm-level log labor productivities belonging to the cell, weights being firm's employment share in the cell. Then, we take weighted average of 4-digit sector aggregate log labor productivities across sectors in a year, weights being sector's employment share in the year. Aggregate labor productivity in a year equals the exponential of aggregate log labor productivity. Annual growth rate in year t is calculated as the percentage growth of aggregate labor productivity from year $t - 1$ to year t . Horizontal dashed black lines show average growth rates in three periods: 2002–2007, 2008–2013, and 2014–2019.

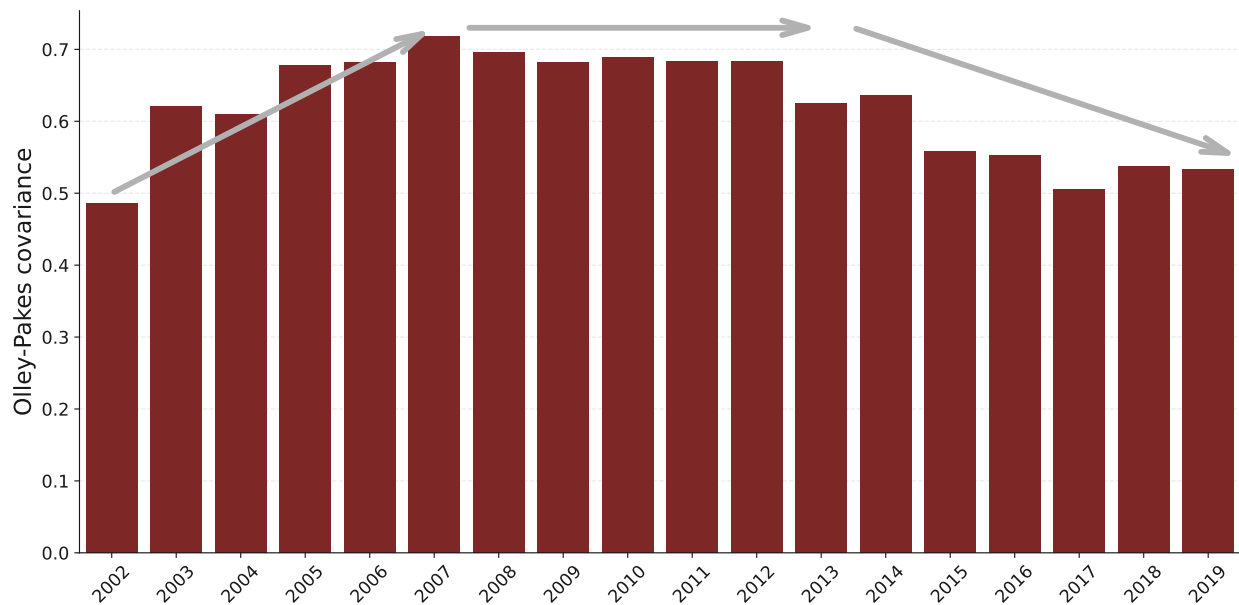


Figure A8: Firm Productivity-Size Correlation Estimated from ORBIS

Notes: The figure plots the covariance term of the Olley-Pakes decomposition of aggregate productivity over years in ORBIS dataset. Aggregate log labor productivity in a year equals $\sum_i \omega_i z_i$, where i is firm, ω_i is firm's employment share in the year, and z_i is firm's log labor productivity. Olley-Pakes decomposition states that $\sum_i \omega_i z_i = \frac{1}{N} \sum_i z_i + \sum_i (z_i - \bar{z}) \left(\omega_i - \frac{1}{N} \right)$, where N is the number of firms, and $\bar{z}$ is the unweighted average of firm level log labor productivities. The covariance term from this decomposition is the second term on the right hand side of this identity. It reflects the association between a firm's productivity and its relative size.

Table A4: Employment Responsiveness to Labor Productivity Shocks (ORBIS)

	(1) 2002–2007	(2) 2008–2013	(3) 2014–2019
Log. Labor Productivity (t)	0.0686*** (0.001)	0.0640*** (0.001)	0.0570*** (0.001)
Log. Employment (t)	-0.0490*** (0.001)	-0.0523*** (0.001)	-0.0417*** (0.001)
Constant	-0.2802*** (0.004)	-0.3078*** (0.005)	-0.2788*** (0.005)
Observations	170,005	164,141	151,852
R-squared	0.082	0.085	0.077
4-digit Sector $\times$ Year FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes

Notes: The table shows the OLS estimation of regression equation (1) using ORBIS data. Dependent variable is firm's DHS employment growth rate from year t to year $t + 1$. Equation (1) is estimated for three different time periods separately: 2002–2007, 2008–2013, and 2014–2019, from left to right. Standard errors are in parentheses. Statistical significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

C.4 Structural Estimation Moments

As a robustness check, we re-estimate our structural model using an alternative set of empirical moments. Specifically, we include Moment 6 (M6), the effect of tax-haven foreign FDI on firm entry rates, to the set of empirical moments we target in the benchmark calibration exercise. This additional moment, valued at -26.5%, captures the decline in incentives for the creation of new firms to the extent that tax-haven FDI into a sector represents a measure of entrenchment. This counterfactual decline in entry rate in the model is calculated as follows. Let $\tilde{x}^*$ denote the counterfactual entry rate under $\delta = 0$ holding everything else constant in equilibrium values. It is defined as

$$\tilde{x}^* = \left[\frac{\tilde{\theta}\bar{v}^*}{\eta\omega} \right]^{\frac{1}{\eta-1}},$$

where $\bar{v}^*$ is the expected value in fair counterfactual with $\delta = 0$ and equal

$$\bar{v}^* = \frac{\pi}{r - g + \tau} + p_H \cdot \frac{\frac{\eta-1}{\theta} x^\eta \omega}{r - g + \tau}.$$

That is, $\bar{v}^*$ is nothing but equal $\bar{v}^f$ given by (8) under $\delta = 0$. Thus, the ratio of counterfactual entry flow without entrenchment to observed entry flow would be

$$\frac{\tilde{x}^*}{\tilde{x}}$$

where $\tilde{x}$ is the equilibrium entry flow rate.

Table A5 summarizes the full set of targeted moments and compares their empirical and model-implied values. Table A6 displays estimated values of the parameters.

Table A5: Model Fit

	Moment	Model	Data	Source
M1	GDP per capita growth	5.8%	5.8%	World Bank WDI Dataset
M2	Firm life cycle profile (Age = 10)	6.25	8.09	FRD, author's calculations
M3	Firm entry rate	8.8%	9.1%	FRD, author's calculations
M4	Share of small firms (Age = 5)	42.5%	52.5%	FRD, author's calculations
M5	Labor productivity - size correlation	0.14	0.12	FRD, author's calculations
M6	Effect of tax-haven FDI on entry	-52.1%	-26.5%	FDI and FRD, author's calculations

Notes: The table reports empirical moments and their model-implied counterparts for the estimation procedure where we additionally target the counterfactual decline in entry when a sector receives tax-haven FDI. Same set of parameters are estimated by jointly minimizing the distance between empirical and simulated moments, with all moments targeted simultaneously. Empirical moments are constructed from the data sources listed in the final column.

This addition allows us to examine whether our key parameter estimates are sensitive to the choice of moments. The comparison between this specification and our baseline estimation (reported in Table 2) reveals a high degree of consistency. As shown in Table A6, key parameters

such as the innovation step size (λ) and the entry probability of high-type firms (p_H) remain stable. R&D productivity levels for both H -type incumbents and new entrants are estimated to be somewhat lower, and their relative gap, captured by the ratio $\theta/\tilde{\theta}$, slightly declines to 6. The estimated value of the entrenchment parameter (δ) is now 98 percent, implying that the advantage conferred by institutional capture is largely comparable to the baseline value.

Table A6: List of Parameter Values

Panel A: Externally calibrated			Panel B: Internally calibrated		
Parameter	Value	Description	Parameter	Value	Description
ρ	5%	Time discount rate	λ	1.094	Innovation step size
η	2	R&D func. curvature	θ	12.666	H -type R&D productivity
L	1	Labor force	$\tilde{\theta}$	2.001	Entrant R&D productivity
			p_H	37.95%	H -type entry probability
			δ	98.39%	Entrenchment rate

Notes: The table reports estimated parameter values for the estimation procedure where we additionally target the counterfactual decline in entry when a sector receives tax-haven FDI. Same set of parameters are estimated by jointly minimizing the distance between empirical and simulated moments, with all moments targeted simultaneously.

Figures A9 demonstrate that the central implications of the model remain robust under this alternative calibration. Key patterns linking entrenchment to firm dynamics, selection, growth, and policy responsiveness are preserved, confirming that substituting the sixth moment does not materially affect the model's core predictions.

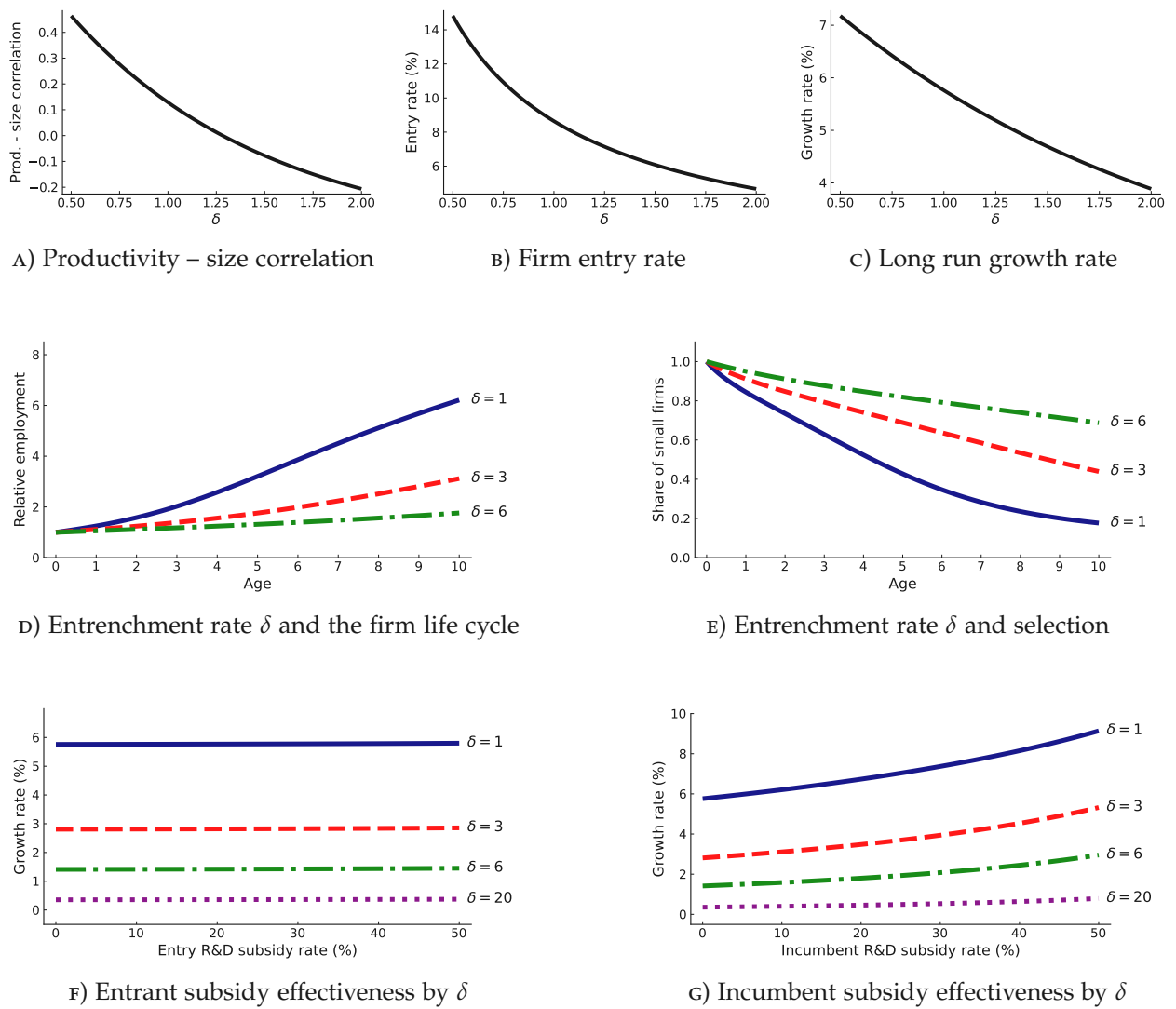


Figure A9: Targeting Productivity – Size Correlation: Effect of δ , Counterfactual Firm Dynamics, and Policy Effectiveness

Notes: Figures show the replication of baseline quantitative results for the calibration where we additionally target the counterfactual decline in entry when a sector receives tax-haven FDI. While the parameter δ is allowed to change in individual panels, the values of all other parameters are held fixed at their calibrated values given in Table A6. Entry and incumbent government policies are implemented separately as in the main text.

C.5 Alternative Estimation Window

In this robustness exercise, we re-estimate our structural model targeting empirical moments from a more dynamic phase of the Ukrainian economy, years between 2002–2007. Table A7 summarizes the full set of targeted moments from the period 2002–2007, and compares their empirical and model-implied values. As can be seen from the table, this period constitutes the most dynamic period in our data. Overall comparison with the previous empirical moments illustrates that, in this period, the average growth rate of the economy is higher, firm life cycle profile is

steeper, the share of small firms is lower, firm entry rates are higher, and the productivity – size correlation is higher, on average. Table A8 displays the estimated values of the parameters.

Table A7: Model Fit

	Moment	Model	Data	Source
M1	GDP per capita growth	8.3%	8.3%	World Bank WDI Dataset
M2	Firm life cycle profile (Age = 10)	9.50	9.50	FRD, author's calculations
M3	Firm entry rate	10.9%	10.9%	FRD, author's calculations
M4	Share of small firms (Age = 5)	46.7%	46.7%	FRD, author's calculations
M5	Labor productivity - size correlation	0.14	0.14	FRD, author's calculations

Notes: The table reports empirical moments and their model-implied counterparts for the estimation procedure where we target average values for the period 2002–2007 instead of 2002–2013. Same set of parameters are estimated by jointly minimizing the distance between empirical and simulated moments, with all moments targeted simultaneously. Empirical moments are constructed from the data sources listed in the final column.

Comparing parameters estimates (Table A8) with the benchmark estimated values (Table 2) reveals that innovation step size and R&D productivity parameters mostly remain stable to this alternative estimation period. The entry probability of high-type firms (p_H) declines from approximately 14% to 10% while the entrenchment rate (δ) increases from 123% to 136%.

Table A8: List of Parameter Values

Panel A: Externally calibrated			Panel B: Internally calibrated		
Parameter	Value	Description	Parameter	Value	Description
ρ	5%	Time discount rate	λ	1.096	Innovation step size
η	2	R&D func. curvature	θ	23.877	H-type R&D productivity
L	1	Labor force	$\tilde{\theta}$	3.614	Entrant R&D productivity
			p_H	10.31%	H-type entry probability
			δ	136.98%	Entrenchment rate

Notes: The table reports estimated parameter values for the estimation procedure where we target average values for the period 2002–2007 instead of 2002–2013. Same set of parameters are estimated by jointly minimizing the distance between empirical and simulated moments, with all moments targeted simultaneously.

Figures A10 demonstrate that the central implications of the model remain robust under this calibration with an alternative time period. Baseline results linking entrenchment to growth, firm dynamics and selection, and policy effectiveness are preserved, confirming that our selection of the targeted time period does not materially affect the core predictions of the structural model.

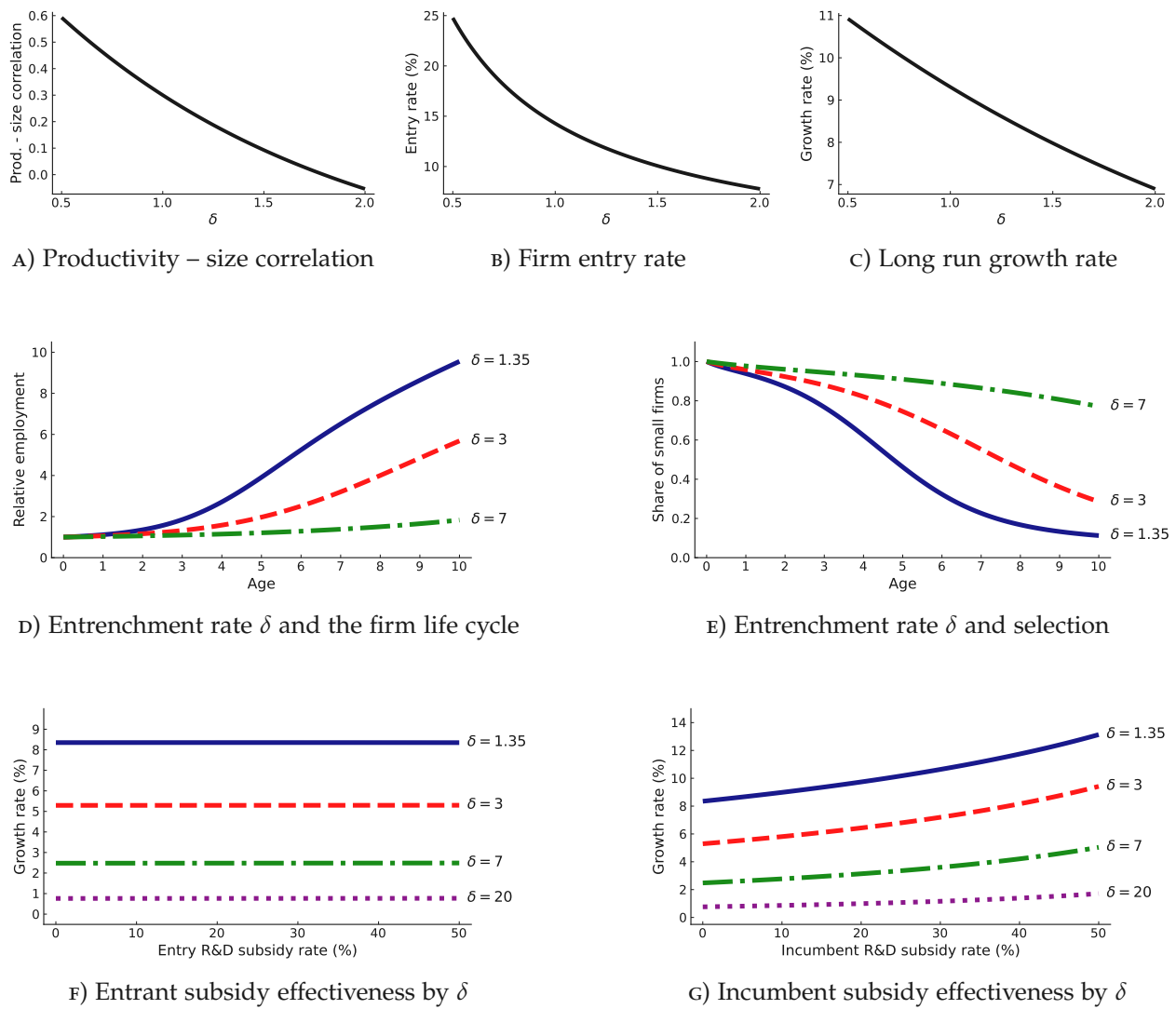


Figure A10: Alternative Estimation Window 2002–2007: Effect of δ , Counterfactual Firm Dynamics, and Policy Effectiveness

Notes: Figures show the replication of baseline quantitative results for the calibration where we target moment values for the period 2002–2007 instead of the baseline period 2002–2013. While the parameter δ is allowed to change in individual panels, the values of all other parameters are held fixed at their calibrated values given in Table A8. Entry and incumbent government policies are implemented separately as in the main text.

C.6 Alternative Definitions of Firm Entry

Figure A11 Panel A presents the time evolution of annual entry rates shown in Figure 8. Entry rates exhibit a persistent decline over time, with a brief uptick after 2014—likely reflecting a temporary recovery as firms that had postponed entry due to shocks around 2014 finally entered the market. This temporary recovery is short-lived, as the declining trend resumes after 2016. Panel B of Figure A11 shows the employment-weighted average of entry rates at the 4-digit industry level, confirming that the declining trend in entry rates is robust to the choice of aggregation

method.

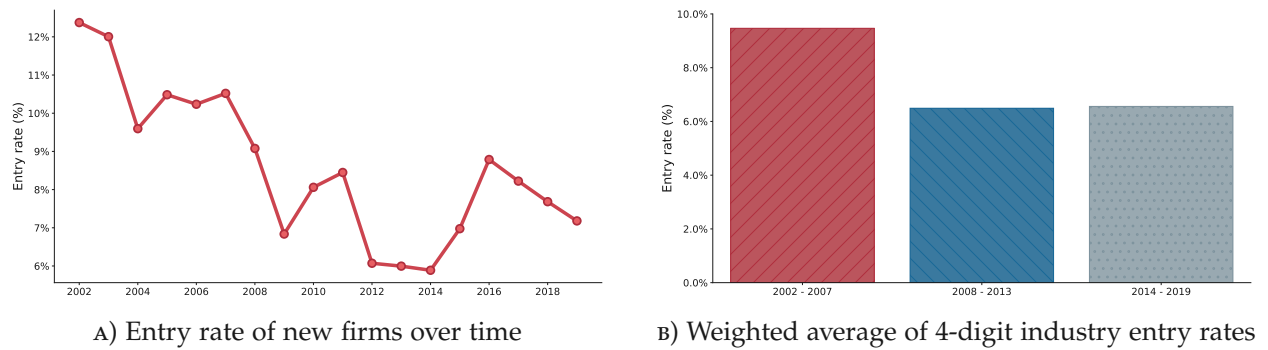


Figure A11: New Firm Entry Rates: Time Series Evolution and Weighted Average

Notes: Panel A shows the time evolution of firm entry rates, which is calculated as the ratio of number of zero-year old firms to number of incumbents operating in the manufacturing sector. Panel B shows the the weighted average of 4-digit industry level entry rates, weights being employment share of industries in a year. Period average equals unweighted average across years in each period.

We further show that the decline in entry rates holds under alternative definitions. Specifically, we recalculate entry rates based on the first year firms appear in the data, rather than their official year of incorporation. This approach mitigates concerns that some firms may delay operations after incorporation. As shown in Figure A12, the declining trend in entry rates persists under this alternative definition.

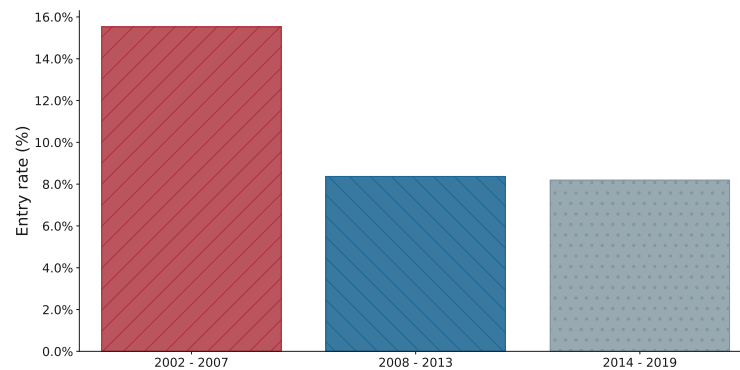


Figure A12: Entry rate of new firms under alternative definition

Notes: The figure plots the average firm entry rate in the manufacturing sector under the alternative definition. Entry rate in a year is defined as the ratio of the number of firms that appear first time in the data to the number of incumbent firms operating in the manufacturing sector. Average entry rate in a period equals the unweighted average of annual entry rates.