Battle of Ideologies: Firm Dynamics and Productivity in Planned Versus Market Economies

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Abstract

How do economic systems dictate the pace and scale of aggregate productivity and firm dynamics? This study delves into the contrasting impacts of economic systems on firm dynamics and productivity by comparing the centrally planned economies of Soviet Russia and East Germany with the market-driven economies of the US and West Germany during the Cold War era. Leveraging unique, newly accessible data, we highlight how the restrictive nature of planned economies stifled the processes of creative destruction and dynamic competition, which are critical for economic growth in market systems. We document little productivity improvements and little labor reallocation in response to productivity shocks and few firms entering or exiting in the communist countries. Through counterfactual simulations, we conclude that US levels of responsiveness to productivity shocks and rates of entry and exit could have boosted growth by about 1.8% per year. This increase in growth would have covered the larger part of the economic gap between Eastern European and Western economies observed in the last decade before the fall of the Iron Curtain.

1 Introduction

Schumpeterian forces of creative destruction drive economic growth in market economies. Dynamic competition incentivizes firms to increase productivity; the winners grow and gain market share, while the losers shrink and exit the market. Reallocation of production factors from exitors and less productive firms to more productive firms fuels economic growth. In contrast, market distortions such as entry and exit barriers or other factors decreasing responsiveness of the economy to innovations result in misallocation of resources and losses

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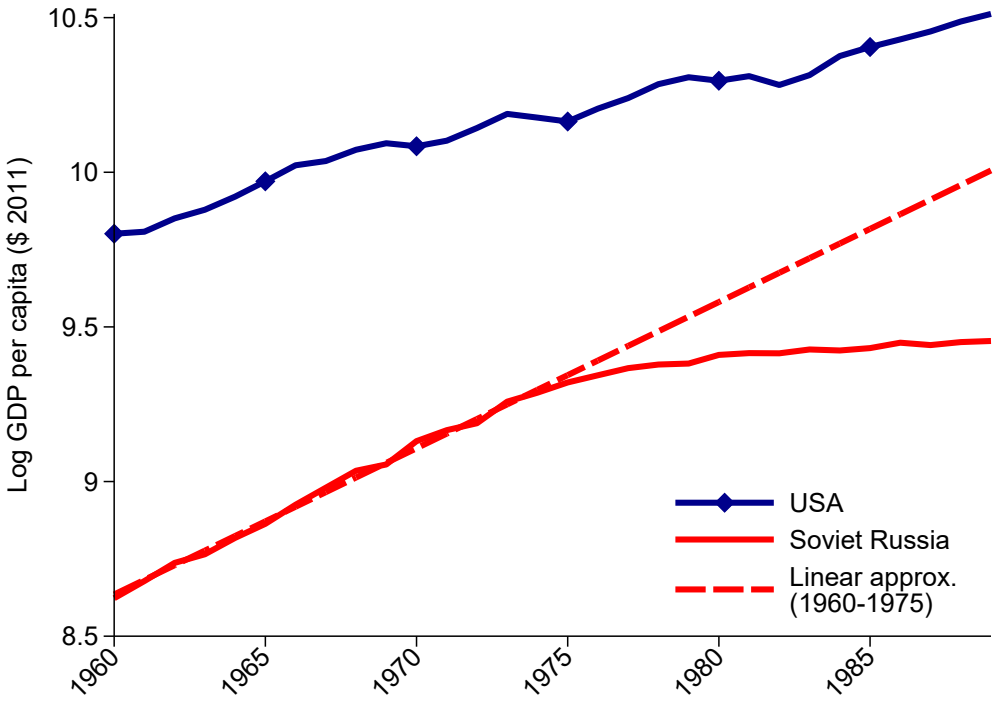
in aggregate productivity (Baily, 1992; Bartelsman et al., 2013; Decker et al., 2020; Foster et al., 2001; Hsieh and Klenow, 2009; Hopenhayn and Rogerson, 1993). Yet, while literature emphasizes the contribution of the market and dynamic competition between firms to allocation efficiency there is the question about the magnitude of the effect. How important are these institutions for economic growth?

To answer this question, we turn to the extreme historical case of planned economies where the role of the market and Schumpeterian forces were deliberately restricted. By design, such economic system relied almost exclusively on within-firm growth, shutting down the other channels. We explore dynamics of manufacturing establishments and productivity in planned economies and compare them against the same characteristics in their ideological counterparts to highlight the impact of (the absence) of creative destruction.

The competition between capitalism and socialism marked economic and political development of the globe in the second half of the XX century. While we know the outcome of this battle, the relative contributions of different economic mechanisms to the collapse of the socialist system are poorly understood (Zhuravskaya et al., 2024). Moreover, if one considers the competition in its dynamics, initially, the planned economies were converging in GDP per capita to the level of market economies as Figure 1 demonstrates. Because of higher rates of Soviet economic growth, the leading economists in the 1960s believed that it was only a matter of time before the Soviet Union would overtake the US, and even put such a prediction in textbooks (E.g. Samuelson, 1961). The stagnation and eventual collapse of the Soviet-type planned economies happened only in the 1970s – early 1990s. In the 1980s, the difference in productivity growth between soviet Russia and the US was 1.95% per year. One possible explanation for such dynamics is gradual exhaustion of capital accumulation as the driver for Soviet extensive catch-up, in line with the predictions of the Solow growth model (Cheremukhin et al., 2017; Ofer, 1987). The neo-Schumpeterian growth framework (Aghion and Howitt, 1992; Aghion et al., 2014) implies that once socialist economies became middle-income counties, the lack of market mechanisms of dynamic competition to reallocate resources efficiently became crucial. We employ recent methodological developments in business dynamism literature and take advantage of newly available unique firm-level data for planned economies to address this conjecture empirically, focusing on the role of factor reallocation.

To be precise, we study the behavior of establishments in manufacturing in selected planned economies – Soviet Russia and communist East Germany (GDR)– and contrast it with selected market economies such as the US and West Germany. For these four countries, we explore firm entry and exit, labor reallocation, their productivity contributions and the input responses of firms to productivity changes. We make country comparisons of reallocation and allocation in the vein of Hsieh and Klenow (2009); Bartelsman et al. (2013) and track the most important business dynamism parameters as explored in Akcigit and Ates

Figure 1: GDP per capita (log) in the USA and Soviet Russia.



Data: Maddison Project Database 2020 (Bolt and Van Zanden, 2020) .

(2023). To better understand the reallocation between firms, we adopt the shock-response framework from Decker et al. (2020) and describe the two economic systems in terms of two factors determining the reallocation in an economy: productivity shocks and the ability of firms to react to these shocks by adjusting factor demand (responsiveness).

Decker et al. (2020) estimate productivity effect of a slowdown in firm responsiveness by assuming a return to higher rates for existing firms and computing the implied aggregate productivity gains. We push this approach further by building several additional simulations of the long term implications of responsiveness to productivity shocks. Specifically, we simulate the economic growth of the GDR and Soviet Russia during the final decade of their existence using parameters of entry, exit and firm responses obtained from the studies of the market counterparts to understand the productivity implications of corresponding mechanisms.

For our analysis of planned economies, we utilize for the first time several unique comprehensive datasets, including those which we hand collected in the former communist archives. Thus, we digitized the establishment-level manufacturing data on the population of establishments in Soviet Russia for 1980, which we manually extracted from the Moscow archives, and combined it with other available datasets on Soviet firms. To cover East Germany, we made the micro-data of the GDR usable, which has recently been declassified by the German Federal Archive. To our knowledge, we are the first to provide firm level evi-

dence for Soviet-type planned economies representative for the entire economy, extending further back than the final years of communist rule.

With our rich collection of data, we are able to draw up firm-level-grounded stylized facts on firm dynamics in planned economies (Soviet Russia and GDR) during the late 1970s and 1980s and compare it to market economies (the USA and West Germany). We document drastic differences between the two systems. Planned economies are dominated by large conglomerates and mid sized firms, have negligibly low levels of entry and exit rates, a substantially lower job reallocation rate and no plant growth conditional on survival. We also show that planned economies were characterized by both smaller shocks (or high productivity persistence) and lower responsiveness to those shocks. The latter implies that once a firm faced an increase in productivity it did not adjust to its optimal size. Together, these findings are broadly in line with speculations of the old Sovetologiist literature, which exclusively relied on anecdotal evidence due to the lack of systematic data, about the smaller role of reallocation in planned systems (we review this old literature in more detail in section 2.1).

In our counterfactual simulation exercise, we find that raising incumbents' responsiveness in the planned economies to the US levels would have yielded roughly 1.1% additional growth in planned economies, while increasing the rates of entry and exit to the US levels would have created another 0.7%. Both measures together would have resulted in 1.8% per year. Differences between the GDR and Soviet Russia are negligible. This accounts for the larger part of the economic gap between Eastern European and Western economies observed in the last decade before the fall of the Iron Curtain. The efforts of planners to introduce and diffuse production technologies were ultimately failures. Our results highlight that entry, exit, experimentation and selection are crucial channels for productivity growth. We have similar but weaker results for West Germany, an economy with more heavily regulated labor markets than the US. Higher responsiveness yields 0.5% per year, while exit only contributes 0.1%. This suggests a continuum between planned and market economy systems.

With these findings, we contribute to several strands of the literature. First, we contribute to neo- Schumpeterian growth literature (Aghion and Howitt, 1992; Aghion et al., 2014; Akcigit and Ates, 2023) estimating for the first time how much the lack of creative destruction and related forces costs for economic growth. Second, we revisit an old debate in comparative economics about relative efficiency of the market and the planning economies (Bergson, 1987; Moroney, 1990), which goes back to the classical writings by Hayek, ed (1935), Mises (1951) and Lange (1936, 1937). We estimate the impact of the difference in institutions responsible for factor allocation on economic growth. And third, we develop economic history literature on Soviet-type planned systems and factors driving their collapse (Morys, ed, 2020; Zhuravskaya et al., 2024), exploring for the first time population-wide firm-level panel datasets.

The remainder of the paper is structured as follows: Section 2 describes the historical background and the main institutions of economic planning in Soviet-type economies as well as our data. Section 3 presents our findings about business dynamism in planned economies. Section 4 simulates counterfactual economies to understand the effect of our findings on aggregate growth. Section 5 concludes.

2 Background and Data

The ideas of planned economic systems have developed in response to contemporary challenges of market economies. Competition, cycles of booms and busts were seen as the signs of the chaotic nature of capitalism that led to unemployment and waste of resources. In contrast, economic planning was aimed to allocate resources with the explicit goal of increase in social welfare.

While Marxism criticized market economies, it did not elaborate ideas on organizing the production process. These ideas were formulated only after the Russian Revolution of 1917, in "The ABC of Communism" (Bukharin and Preobrazhenskij, 1920). The production process was viewed to be organized as one country-wide workshop, with former individual firms turning into its subdivisions. They were supposed to follow a plan that covers both production targets and allocation of resources required to meet the targets. This general approach was gradually implemented after the start of the first-five year plan in 1928 and refined during further decades through trial and error. The next section outlines the organizational structure that emerged from these efforts.

2.1 The Institutions of the Planned Economy

Planned economies were organized and managed through a hierarchical structure, that was aimed at centralized decision-making and resource allocation. At the top of the hierarchy was a political body – the "Politburo", the highest policymaking authority of the communist party – that defined the political goals and set the directions for the economy's development. In theory, the political leadership had complete freedom to switch the direction of economic development, and there had been some radical shifts in certain periods (e.g. the Soviet government started to allocate more resources to light industry and production of consumer goods after the death of Stalin). However, in practice such interventions were limited; the central planner preferred to set up future targets from the achieved level, i.e. the current production plus a fixed percentage increase, that allowed to mitigate the information constraint.

The principle means of directing the economy was the five-year plan. It set up the economic goals that the political leaders aimed to achieve in the next 5 years and the means by which they wanted to do this. Annual and quarterly plans specified targets for the shorter

time periods. For all plans, the Politburo set up the future goals in general terms. The task of the State Planning Committee was to transform this general vision of political leaders into detailed and, in theory, coherent plans for industries. Planning at the highest level implied to specify output targets for industrial ministries, as well as to define investment, allocation of labor, and innovation needed to fulfill the production tasks. The industrial ministries in turn allocated the targets and the required resources to the existing enterprises and made decisions on establishment of new ones. At all levels of the state bureaucracy, planning involved bargaining between the higher- and lower-level agents, e.g. between the government and industrial ministries or ministries and their enterprises. The subordinates used information asymmetry about local conditions to argue for more resources and lower output targets, but the superiors made the final decisions (Zaleski, 1980; Gregory, 1990; Markevich, 2003).

Such hierarchical structure of decision-making was intended to allocate targets and resources in the absence of the price mechanism. Yet, it was the major weakness of the system, which was formulated by Hayek (1945) as the "knowledge problem". He argued that the efficient allocation of resources is not possible as the planner is unable to collect and process all the relevant information about the resource scarcity and marginal benefits of putting resources into either of the industries. Importantly, central decision making, he argued, deprived individual actors from the price signals that would allow them to adjust to new problems, or take advantage of new opportunities given by changing local conditions. Ultimately depriving the economy of the entrepreneurs and innovators who end up on the sidelines watching as spectators, rather than central actors.

Soviet and GDR five year plans constantly called for "a further substantial improvement of labor productivity, effectiveness and product quality" (Bornstein, ed, 2019), i.e. the central planner viewed within firm productivity improvements as a major strategy to grow. To support productivity growth and innovation within plants, alongside with the production planning hierarchy there existed innovation planning hierarchy. The state planning committee was supported by the State Committee for Science and Technology, each industrial ministry had its technical council, which coordinated the innovation activities of the industry in close contact with the Academy of science and R&D institutes. They were supposed to formulate the demand for innovation that was coming from the target for output growth, and coordinate the efforts of basic and applied research. Once the new production processes and machines were developed, they should have been distributed to the production plants for implementation (Berliner, 1976).

Yet, enterprises had limited incentives to adhere to the plan or adopt new technologies. Enterprises neither faced competitive pressure nor had incentives to capture larger market shares. On the contrary, the unauthorized attempts to expand the business beyond the designated markets would be accused of "poaching in foreign territories" (Berliner, 1976).

Competitive pressure would largely contradict with ideology, which implied full employment and priority of social goals over economic ones: workers should not suffer neither due to plant closure nor due to the expansion of other plants. For that reason, there was virtually no bankruptcy or exit of inefficient plants. Whenever a plant was facing troubles, it would receive help from industrial ministries in forms of subsidies, adjustments of plans, prices or taxes. Kornai (1980) formulated it as "soft budget constraints" that allowed plants to rely on external help rather than on increase of own productivity. Soft budget constraints were not only stealing incentives to innovate, but also made it harder to abandon less promising avenues of R&D: getting additional financing for an already approved albeit less promising project was easier than getting a new, more promising project approved.

To create the incentives for enterprises, the government rewarded the managers for plan fulfillment proportionally to the output. On top of bonuses for plan overfulfillment, this also meant the "enterprise fund" at the firm level that profitable or plan fulfilling plant managers could use to invest in the plant, reward workers, etc. The reward schemes varied over years because the socialist governments experimented with their exact design (e.g., the Kosygin reforms in the USSR in 1965 and the new economic system in the GDR in 1963 are probably the most famous). Yet, Soviet-style bonus-based incentive mechanism did not generate incentives comparable to the ones of profit-maximizing firm owners in a market economy. Every attempt to modify the artificial bonuses only revealed another area with insufficient incentives (Berliner, 1976).

In practice, the revenue plan target was by far the most important target for managers and dominated their considerations. While one might assume that this produced perverse incentives and led to setting prices very high or closing all but the most productive parts of the plant, it is important to keep in mind that managers had to operate within the plan. Neither prices nor inputs could be changed without renegotiation with the ministry. Thus, increasing plant TFP was the main way the manager was supposed to earn bonuses. This worked mostly, though there are some famous cases when Soviet or GDR plants traded the same goods back and forth to increase their revenue, or shifted their output toward the most expensive goods. Accordingly, the literature conceptualizes plant managers as bonus maximizers (Berliner, 1957).

Above issues described above, the Soviet-style bonus scheme incentived managers to push back by incurring a well understood dynamic problem, the so-called "ratchet effect" (Weitzman, 1976; Holmstrom, 1982; Freixas and Tirole, 1985). In a static planner-manager setting, it is optimal to give higher performing plants higher targets in order to motivate them to invest effort. However, in a dynamic setting this discourages efforts since managers anticipate that their productivity advancements will lead to higher plan targets, and thus they will enjoy less long term benefits from leading a more productive plant.

In theory, the planner was supposed to reallocate resources toward more productive

plants in order to increase the overall output of the economy. In practice, practical problems intervened: information problems, various regulations, ideological considerations and lobbying by networks of managers and bureaucrats. In addition, the practicalities of planning inhibited any change. E.g. after a plant had received additional workers, a new output target had to be negotiated together with new plans for capital investments and intermediate inputs. Labor reallocation was also subject to ideological constraints. In a proletariat state, workers could not suffer from technological progress, so a labor saving plant had to find new work for the dismissed employees, either within the plant or outside of it. Furthermore, plants were not only the units of production, but also providers of social benefits such as housing, childcare, vacations and more. Hence, an exit of an unproductive firm would imply that workers are deprived of social benefits, and, hence, was ideologically undesirable and practically very rare (Berliner, 1976).

2.2 Growth through capital accumulation in Soviet-type planned economies

The Soviet-type planned economy heavily relied on accumulation of capital as the dominant growth strategy (Gregory and Stuart, 1986; Ofer, 1987). As discussed in the introduction, such a strategy worked relatively well until the 1970s that is broadly in line with Solow growth framework. Indeed, Solow (1956) describes economic growth as a function of capital accumulation and exogenous technology growth. Countries with a low capital stock per worker can create substantial growth simply by accumulating capital. However, it does not increase the steady state growth rate to which the economy converges. Once the steady state capital per worker has been accumulated, growth slows down. A strategy of capital accumulation thus cannot lead to long term sustained high growth rates.

Planned economies had been lagging behind their market counterparts in terms of capital stock, but were rapidly accumulating capital, as Figure 11 in the Appendix B suggests. Moreover, standard national accounting exercise reveals negative TFP growth during the last two decades before the collapse of the Soviet Union. Table 1 decomposes manufacturing output growth into input and productivity growth for our four economies between 1961 and 1990. Planned economies' growth performance is not dismal, but it is overwhelmingly driven by capital deepening (roughly 2% per year). TFP growth in East Germany is negative over the entire period and TFP growth is declining for the USSR (turning negative after 1975, see Table 4 in the Appendix). In contrast, market economies' growth is mostly driven by TFP growth, with additional contributions from capital deepening and population growth (only in case of the US).

The earlier literature from the 1980s (Bergson, 1987) has debated extensively the extent to which this is 'true' negative TFP growth or an artifact driven by poor data (hidden inflation in capital series) or a wrong choice of theoretical model (the rate of elasticity of substitution between capital and labor). In the following sections, we will use micro data to explore the

functioning of the planned economy and understand the missing aggregate TFP growth.

We will show that allocative efficiency in the planned system was continously worsening, given the firm level reallocation patterns we observe. Depending on the other sources of growth, this can lead to negative productivity growth in the aggregate. Thus, the declining aggregate productivity of the planned economies in the 1970s and 1980s was a feature of the planned economy rather than a bug in policy implementation.

Table 1: *Decomposition of Industrial Output Growth: Yearly Average (1961-1989)*

	Planned economies		Market economies	
	East Germany	Soviet Russia	West Germany	USA
Industrial Output	1.7%	3.48%	2.59%	3.3%
Among which:				
TFP	-.44%	.78%	**1.99**%	**1.58**%
Capital	**1.91**%	**1.98**%	.9%	1.3%
Labor	.23%	.73%	-.3%	.42%

Notes: Computed assuming constant returns to scale and $\alpha = 0.33$. Growth series for planned economies based on physical output growth.
Data: West Germany: capital and industrial output from Heske (2013), East Germany: capital from Heske (2013) , perpetual inventory method; industrial output growth from Sleifer (2011). USA: US Census Bureau, Russia: industrial output growth series from Ponomarenko (2001) based on official statistics on the physical output growth, capital growth series from Voskoboynikov (2021) computed with the perpetual inventory method.

2.3 Data Sources

This section describes the data sources that allow us to compare the firm level sources of growth across the planned economies of Soviet Russia and East Germany, as well as the market economies of the US and West Germany. We follow this with a discussion of concerns regarding the validity of communist country data and a discussion on prices in planned economies.

We use manufacturing establishments or plants as the unit of observation. We do not use firms as the unit of observation because the concept of firm is misleading in application to Soviet-style planned economies where the state owns all major means of production. In contrast, plants in the planned economies are well-defined objects. They are jointly organized production processes headed by a plant manager responsible for plan fulfillment. They were usually, but not always in one geographic location. Enterprises from the same industry were subordinated to the same industrial ministry.

To be precise, we use the "plant registry number" (East Germany), the enterprises "with own balance sheet" (Soviet Russia), the "establishment" (US census) and the "plant ID" (IAB; West Germany) as roughly equivalent entities. We note, however, that they are not hundred-percent identical and even the in market economies' definitions of plants slightly differ. In planned economies, due to managerial or logistic reasoning, similar or related plants were sometimes organized in a state trust or association but the majority were directly subordinated to industrial ministries. We follow our sources to define the unit of observation for planned economies. We focus our analysis on the manufacturing sector to increase the comparability of our samples, since the sector composition is very different across our four countries.

2.3.1 Soviet Russia

Our basis for the description of the economy of Soviet Russia is the archival administrative records from the Russian State Archive of Economy. We manually digitize the 1980 records on performance of industrial firms and obtain the already digitized 1989 records.[1] Both firm level cross sections cover the entirety of civilian manufacturing in the Russian Soviet Socialist Federation, the largest republic of the USSR (according to the official figures, Soviet Russia produced about 60% of the economic output of the USSR). The dataset contains more than 20 thousand firms and covers roughly 75% of manufacturing employment (mostly due to military and dual-purpose productions, which is classified even today). After digitization, we manually relate firms in both cross sections with each other to understand entry, exit and reallocation.

Lastly, we use the Brown et al. (2006) data which contains yearly firm level data for former USSR manufacturing firms before and after their privatization (1985-2000). A comparison of Brown et al. (2006) cross-section for 1989 with the 1989 records reveals that two datasets report the same variables for observations found in both and likely have the same origin but Brown et al. (2006) has fewer firms. There are 12.000 firms in Brown et al. (2006), so this dataset covers over half of the firm population. By its nature, Brown et al. (2006) does not properly account for entry and exit. For that we use a comparison of 1980 and 1989 datasets.

We detail our treatment of these data sets in Appendix A.

2.3.2 East Germany

After unification in 1990, the German Federal Archive inherited the microdata stored in the archives of the GDR, the socialist state set up in East Germany after the second World War. Since the planned economy relied on substantial statistical knowledge, this data is

[1] We thank Barry Ickes for sharing the 1989 firm-level manufacturing data with us. A comparison of this data with original archival files for 1989 confirms the authenticity of the data.

quite comprehensive. Most important for our purpose are the firm registry, the firm employment survey, the firm production survey and the firm plan accounting. Together, these four surveys form our data set for GDR. The data covers 100% of employment in the GDR economy, but the firm production survey and the firm plan accounting are subsamples that we reweight using estimated probability weights.

We detail our treatment of these data sets in Appendix A.

2.3.3 USA

We use the BDS provided by the US census bureau to characterize business dynamism in the US. The BDS is derived from the Longitudinal Business Database, containing a census of US establishments and firms with employees. The BDS computes establishment reallocation, entry and exit rates for groups of firms according to the same definitions we use in section 3. Otherwise, we rely on the extensive literature on US productivity developments, which already reports the majority of parameters of interest for us. E.g. Pancost and Yeh (2022) decompose productivity and Decker et al. (2020) estimate the responsiveness and shock components to productivity.

2.3.4 West and Unified Germany

We can construct a comprehensive picture of the German economy before and after unification using three different sources. We use the plant level social security data gathered by the IAB ("BHP"). It covers the universe of establishments with at least one employer subject to social security in West- and later unified Germany between 1975 and 2020. However, while this is administrative data of high quality that allows a clear picture of entry and exit, it unfortunately does not contain any non-employment related variables. This makes this data useless for conventional productivity analysis. Within the IAB data universe, revenue and other economic variables are only available for a representative subset of firms from 1993 onwards. Unfortunately, response rates to this voluntary survey are poor for entering and exiting firms, which limits the usefulness of this data for some of our analysis. Thus, we use the microdata from the statistical offices of Germany from 1995 onwards. Specifically, the AFiD data is a mandatory survey of German manufacturing firms above 20 employees. We use these data to understand incumbent responsiveness in Germany in the 1990s. We supplement it with digitized German business registry ("Unternehmensregister") also at the statistical office, which contains the mandatory registry reports of all German firms and starts in 2002.

2.3.5 The credibility of data from planned economies

Apart from the usual issues with making international comparisons, there is also the question of the reliability of statistical data from planned economies. This issue was already

debated while these economies were still operating. The majority opinion (defended e.g. by für Wirtschaftsforschung, ed (1977); Davies and Wheatcroft, eds (1994)) held that while incorrect numbers were sometimes published, Soviet and GDR propaganda worked mostly through omission of inconvenient facts and convenient definitions of key variables, so that published material was usable when exercising caution. In support of this view, it was noted that USSR and GDR state agencies used the public numbers for planning and running the economy. Opening the archives after the collapse of communism revealed that communist governments had no alternative 'secret' statistics (Gregory and Harrison, 2005). In GDR, however, there was a number of cases of direct falsification of data. In unified Germany, the government established a committee to analyze all parts of the old GDR state, which found evidence of substantial forgeries of aggregate data in the statistical offices (von der Lippe, 1995; Ritschl, 1995). Simultaneously, academia revised their estimates for GDR productivity downwards substantially after actually observing GDR firms (e.g. Akerlof et al. (1991); Ritschl (1995)). This led to widespread cynicism regarding any statistical output of the GDR, also shared to a large degree in application to the Soviet statistics despite an absence of similar investigations for the Soviet economy. However, the forgeries concerned headline numbers important for propaganda and politics within the highest bodies. No attempts seem to have been made to bring lower aggregates (estimated from disaggregated statistics) in line with the new numbers and thus modern reconstructions of East German and Soviet economic indicators generally start from lower levels of aggregation, i.e. sector level estimates (Heske, 2013; Glitz and Meyersson, 2020).

We use plant level data for our main analysis and are thus confident that our data has not been tampered with systematically. We can directly see this when comparing the evolution of aggregates created from the establishment level with the official publications. E.g. in the GDR case, von der Lippe (1995) details the discussions between party and statistical office regarding aggregate growth statistics for the year 1988. In the end, industrial production allegedly grew by 4% in the first half of the year, seemingly to mirror a commitment by the party to reach 4% GNP growth in 1988. In the micro data, nominal growth of industrial revenue is 1.4% for 1988. The statistical office was aware of these discrepancies that already existed at the sector level, and was thus extremely secretive with lower aggregate numbers, but made no effort to reconcile the data with the official growth numbers.

Apart from tampering from the statistical office, there are also concerns about data forgeries at the plant level, since manager bonuses and careers depended on plan fulfillment. However, the central planners were aware of this incentive and plant statistics were heavily audited by the statistical office (Harrison, 2013).

Managers in planned economies could also try to explore a legal way to inflate the revenue. Since firms faced output targets in nominal values, they had incentives to introduce "new" products of higher prices and, purportedly, of higher quality, which in fact were only

very minor modifications of existing products. The planner undertook various strategies to address such opportunistic behavior, e.g. Berliner (1976) sees plan readjustments as a way to combat these tactics. Also since managers had the same incentives to inflate output, firm-level figures are comparable against each other.

2.3.6 Prices in Soviet-style planned economies

State prices and socialist accounting practices create additional problems with the interpretation of statistics in planned economies. These prices were fixed by the state, and they do not reflect relative scarcities of goods. Importantly, however, state plants faced the same prices set up by the central planner that makes monetary indicators, such as output, of firm producing the same or similar goods comparable against each other. Plants did not observe any other prices beyond state prices (Bornstein, 1962, 1965).

In our datasets, we observe output in so-called enterprise wholesale prices. The central planner set up these prices using average costs of production in the corresponding branch of industry, adding a small markup (between 5 and 10 percents) to ensure that an average enterprise shows "profit". Specifically, the planner accounted for costs of labor, costs of intermediate inputs, capital depreciation, payments for overhead, and since 1965 capital rental charges (but not land rental charges). In some cases, regional differences in costs were also taken into account. The center revised enterprise wholesale prices periodically but not each year because prices were a part of managers incentive scheme. They were revised in 1929, 1937, 1940, 1950, 1955, 1967. From 1967 till the 1980s, the enterprise wholesale prices were mostly stable (Bornstein, 1962; Gregory and Stuart, 1986).

Firm labor productivity (output in the enterprise wholesale prices divided by the number of employees) shows the labor productivity of this firm relative to other firms in the corresponding branch of industry (and sometimes region) measured in state prices. Because of Soviet incentive system, higher labor productivity increased firms' profits (above "normal" 5-10 percent) that transformed on extra bonuses to the management and labor.

3 Schumpeterian Dynamics

Both planned and market economic systems pursue two core goals: efficient resource allocation and stimulation of productivity growth. However, the two systems had different approach to these goals. In market economy productivity growth and resource allocation is reached with the means of Schumpeterian dynamics: forces of competition and creative destruction stimulate productivity growth within firm, foster reallocation of resources from less productive exiting or declining firms to growing more productive or new ones. Planned economies, on the other hand, aimed to solve these tasks with the administrative methods: productivity growth should have been a product of state-led R&D, both basic and ap-

plied, and the allocation of resources was done by the planner and the subordinate bodies within the planning hierarchy. Labor reallocation was not in contradiction to the ideology of planned economies. Yet, qualitative evidence suggests they were low in dynamism (see Section 2.1 for details). Which of these setups is more successful in which dimensions is in the end an empirical question.

With our novel data for the late 1970s and 1980s, we are able to answer this question. We compare reallocation dynamics in four economies: planned economies are represented by East Germany and Soviet Russia and market economies by West Germany and the USA. This section presents for the first firm level evidence of reallocation dynamics in the planned economy and contrasts these evidence against a description of similar dynamics in the market economies. It describes the firm size distribution and labor reallocation, the entry-experimentation-shakeout process through which new firms enter the economy, the magnitudes of the productivity shocks that ultimately cause reallocation and the responsiveness of the market and the planner to these shocks.

3.1 Business Dynamism

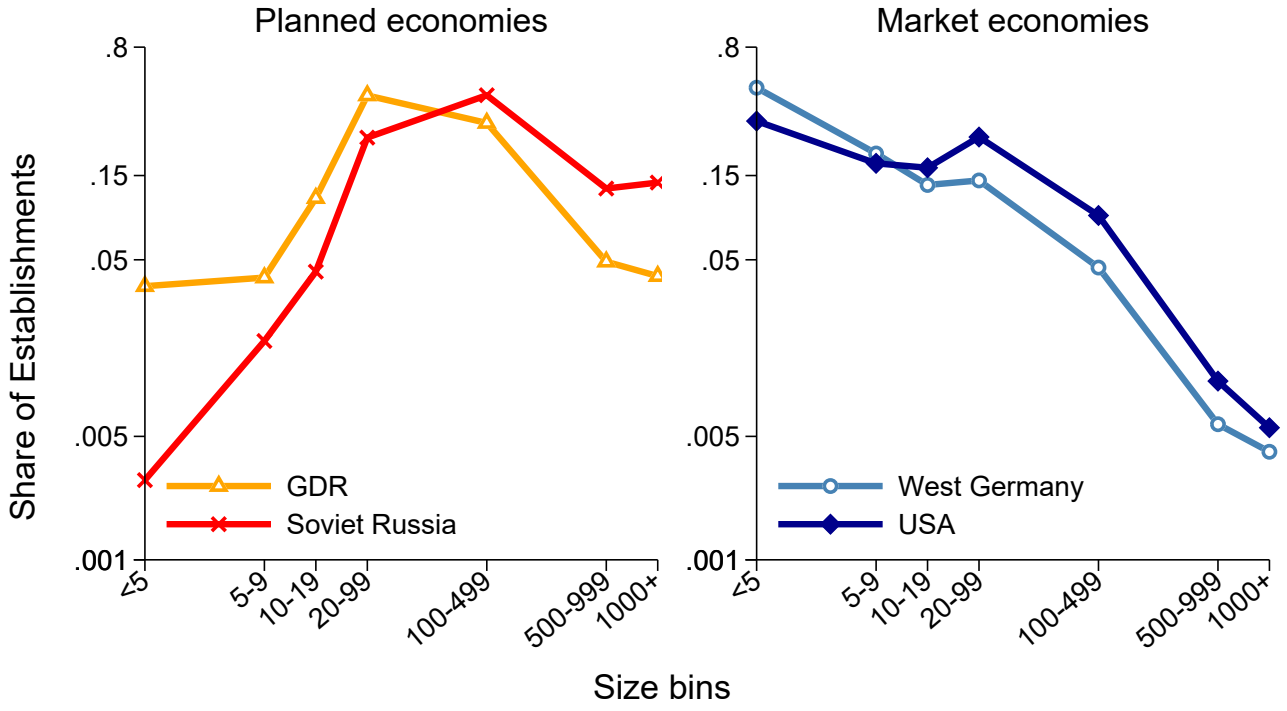
In this section we document stylized facts on business dynamism in planned and market economies. We reproduce key reallocation indicators for planned economies such as job reallocation rates, entry and exit rates, as well as reallocation dynamics over the life cycle. For this analysis we focus on the establishment level as the locus of production, which has a comparable definition across systems. However, our analysis of new plants specifically focuses on new plants that are also founded by new firms: Newly registered plants of existing firms are often the result of reorganization in both systems and behave more like mature plants in any case.

The stark differences between planned and market economies are clearly visible in the indicators we estimate. We start with the plant size distribution, which is shaped by the underlying reallocation processes: how many plants can enter and exit the market, and how fast they grow determines the number of big and small establishments. Figure 2 presents the plant size distribution for planned and market economies, namely, the share of plants of each size bin in the total number of plants in log-log space. In market economies, small plants dominate, and the size distribution appears roughly linear in log-log space.[2] In contrast, a hump-shaped size distribution in planned economies highlights the predominance of large plants. Most of the plants in planned economies are larger than 100 employees, while most of plants in market economies are smaller than 5 employees.

This difference in size distributions stems from the difference in the structure of decision making. In market (or decentralized) economies, all decisions are made by individual firms

[2]In market economies firm sizes exhibit heavy-tailed distributions, closely approximating Zipf's law. This means the size of firms is inversely proportional to their rank when plotted in log-log space. For examples see Axtell (2001), Fujiwara and Souma (2003), and Gabaix and Landier (2008).

Figure 2: Establishment size distribution



Note: The shares of establishments in each size bin are averages across 1980, 1989.
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East Germany), IAB EHP (West Germany), US Census Bureau BDS (USA). For a detailed description of the data sources, see section 2.3.

competing with each other, while planned (centralized) economies are organized according to the top-down approach where the planner makes the key decisions about the organization of the economy. In planned economies, the complexity of these decisions increases with the number of production units (Berliner, 1976). Hence, organization of production process into a smaller number of larger plants reduces the scope of work for the central planner. The importance of the span of control in deciding on the size and number of plants is illustrated by the difference in size distributions for East Germany and Soviet Russia. For the latter the span of control problem was more acute due to substantially larger size of the economy and territory, and as a result, Soviet Russia had substantially larger plants comparing to East Germany.

Limited ability of the planner to control and manage the subordinate enterprises may also have implications for the reallocation dynamics. Next section presents the key indicators of reallocation in planned and market economies.

3.1.1 Employment Reallocation

The speed of labor reallocation between plants is a natural measure of creative destruction in an economy. It reflects the rate with which new ideas, technologies or business models

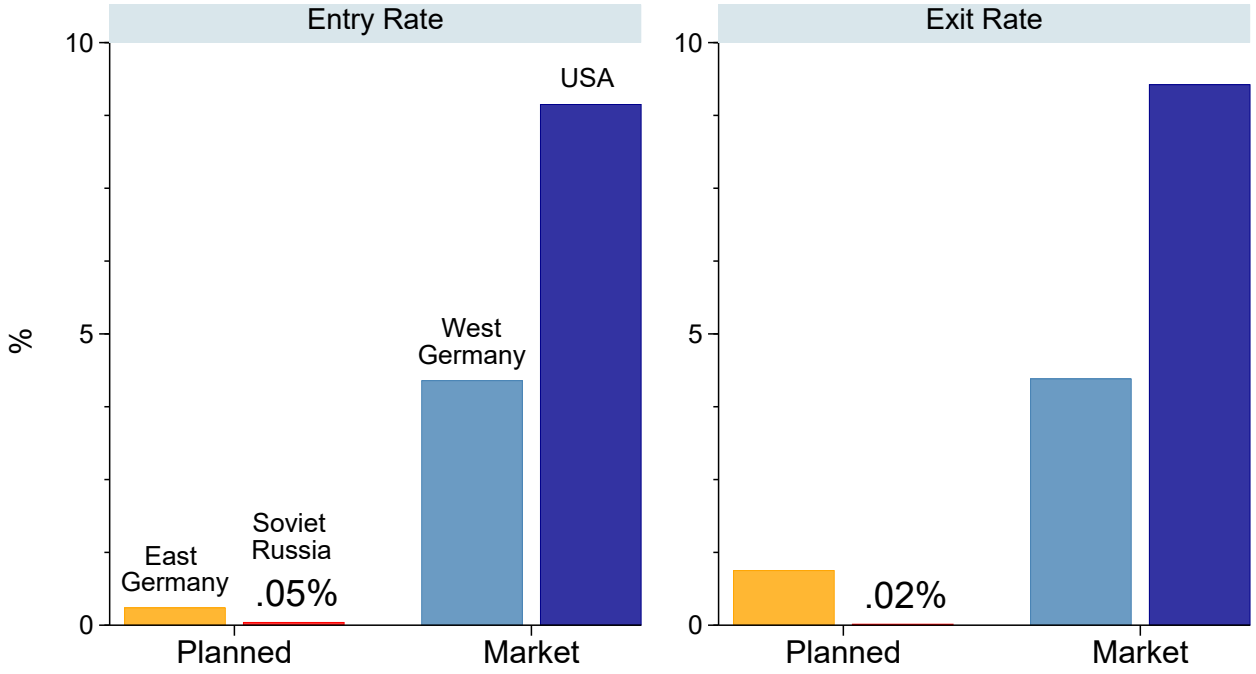
are introduced to the market by the entrants and how fast good ideas are sorted out via exit of unproductive firms and reallocation of labor to productive ones. In this section, we compute the key measures of employment reallocation rates for planned and market economies: entry and exit rate, and job reallocation of incumbents.

For market economies, the role of entry and exit for productivity growth is borne out by empirical analysis, which has shown that newly entering firms play a crucial role in introducing and spreading new technologies throughout the economy via entry, experimentation and a selection of successful experiments (Cunningham et al., 2021). Young firms are also more responsive to shocks (Decker et al., 2020) and those that survive and grow make outsize contributions to job creation and productivity growth (Haltiwanger et al., 2013, 2016; Bravo-Biosca et al., 2013). In addition, evidence suggests slowing the reallocation towards newly founded firms impedes growth (Akcigit et al., 2021).

In planned economies, on the other hand, entry and exit play a different role. First, the planner controls all the plants in the economy, and hence could theoretically introduce new technologies to existing plants without an exit of an existing plant and a subsequent entry of a new one. If a new technology could not be introduced into an existing plant or the planner aims to expand the number of production units, then a new plant could be launched. Anecdotally, this process was being significantly slowed down by the bureaucracy (lengthy process of design and launch of new projects). Second, the planner's decisions on plant shutdowns were largely affected by ideology: social goals and full employment were of highest priority, and hence, unproductive plants could not be shut down if that could entail job loss. Thus, entry and exit rates are expected to be lower in planned economies.

Figure ?? reports entry and exit rates in planned and market economies. As expected, in both East Germany and Soviet Russia, entry and exit rates are negligibly small comparing to market economies. In market economies, on the other hand, the difference is more pronounced: both entry and exit rates in West Germany are about half when compared to the US suggesting lower business dynamism.

If entry rates show the rate of introduction of ideas to the market, then the employment share of young firms reflects the fraction of the employed population engaged in the development and testing of these ideas. The employment share of young firms is jointly determined by they entry rate, the size at entry, and subsequent growth dynamics during the first five years after entry. Figure 3 reports the employment share of young plants. For planned economies it is relatively low, but not as low as entry rates. The reason is the size of the plants at entry. Since the planner defines the size at entry, the plants are already large, which leads to higher share of employment in young plants. Interestingly, West Germany looks more similar to planned economies, than to the US. This is, again, explained by the combination of low entry rate and small size at entry: 3 employees in West Germany vs. 10 employees in the US.



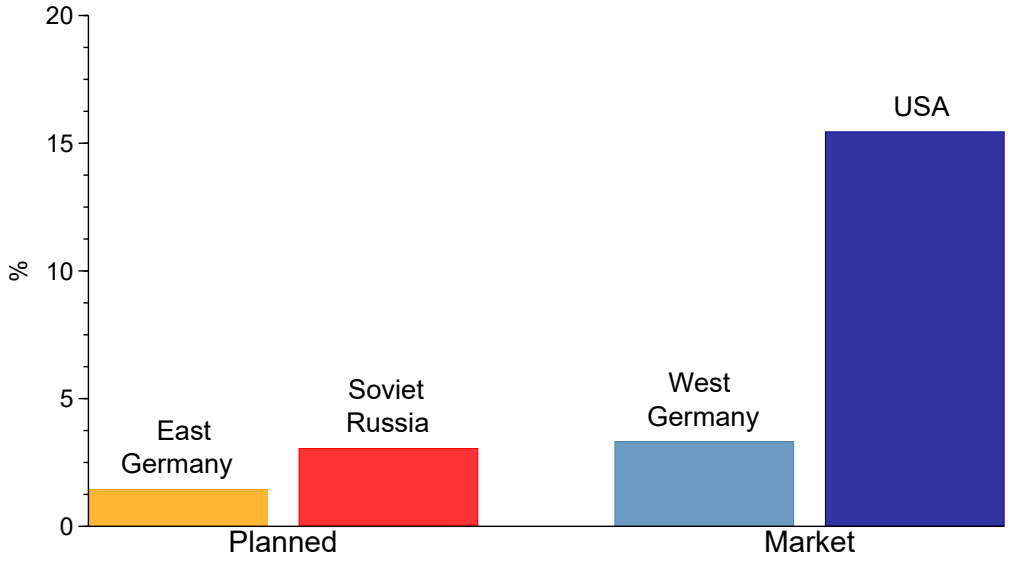
Note: Average values across several years: East Germany (yellow): 1983-1988, Soviet Russia (red): 1980 & 1989 , West Germany (light blue): 1980-1988, USA (blue): 1980-1988. Manufacturing sector. Soviet Russia: due to data limiattions not all unmatched firms in crossections can be verified as true or false entry and exit; to counteract this, entry and exit rates are computed using reweighting towards verified true and false entry and exit. See details in the text.
Data: USA: BDS, West Germany: IAB EHP, GDR: The Statistical Office of the GDR, Soviet Russia: The Central Statistical Directorate of the USSR The underlying numbers are presented in Table 5.

Figure 4 reports the job reallocation rate computed following Davis and Haltiwanger (1992). It captures the share of jobs that shift in and out of firms in a given year.[3] Typically, in market economies, labor is reallocated from less productive to more productive firms, as a result of selection and creative destruction. Theoretically, the same should hold true for planned economies. In fact, as planners aimed to increase aggregate productivity, it was in their interest to promote labor reallocation. The reallocation of labor did not contradict ideology as long as it did not threaten job security. Job reallocation rates, presented in Figure 4 generally follow the same pattern as entry, and exit; that is, very low reallocation rates for planned economies, and reallocation rates for West Germany that are half when compared to the US.

To summarize, all the four measures of reallocation dynamics show a very similar pattern: low or even negligible dynamics for planned economies when compared with the high rates in market economies, and significant differences across the two market economies un-

[3] $JRR_{c,t} = \frac{\sum_i |e_{j,t} - e_{j,t-1}|}{\sum_i 0.5(e_{j,t} + e_{j,t-1})}$. This measure is naturally bounded between 2 (for entering firms) and -2 (for existing firms), but here we restrict the analysis to continuing firms.

Figure 3: Emloyment Share of Young Plants (less than 5 years old)

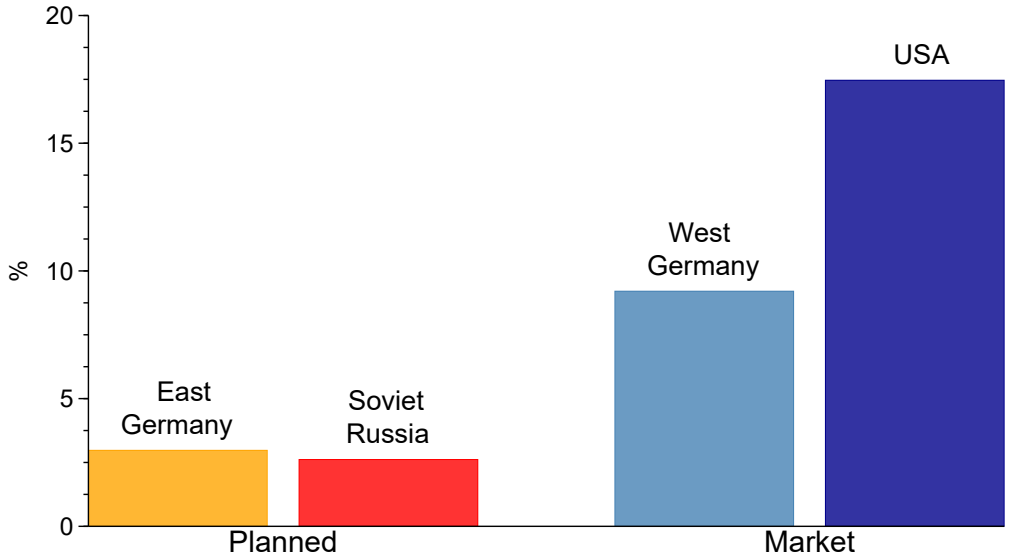


Note: Average values across several years: East Germany (yellow): 1983-1988, Soviet Russia (red): 1980 & 1989, West Germany (light blue): 1980-1988, USA (blue): 1980-1988. Manufacturing sector. Soviet Russia: due to data limitations young plants are represented by entrants between 1980 and 1989.
Data: USA: BDS, West Germany: IAB EHP, GDR: The Statistical Office of the GDR, Soviet Russia: The Central Statistical Directorate of the USSR The underlying numbers are presented in Table 5.

der analysis with West Germany exhibiting about half of the dynamism of the US economy. The similarity of the two planned economies can be explained by the fact that the economic system of the GDR was copied from the system of the USSR (Morys, ed, 2020). The lower reallocation dynamics we estimate in West Germany relative to the US are in line with the literature (Bartelsman et al., 2013; Biondi et al., 2023). Lower dynamism in European countries is often attributed to higher labor adjustment costs: e.g., the OECD Employment Protection Index (ranging between 0 and 6 with the latter being the highest possible employment protection) was almost 0 in the US and around 2.5 in Germany in 1990s (*OECD Indicators of Employment Protection*, n.d.). In that sense, regulation and business dynamism might be better represented by a continuum on which countries place themselves instead of a discrete choice between market and central planning.

The difference between the planned and market economies not only points to the limited reallocation that enterprises in planned economies faced, but also a distinctly different approach of planned economies to productivity growth. While planned economies relied on within-enterprise productivity growth, market economies relied on market experimentation and selection. In practice, reallocation through entry, exit, and growth dynamics, served the purpose of introducing and selecting the better technologies in market economies. By contrast, in planned economies this was intended to be done by the central planner who

Figure 4: Job Reallocation Rates (Incumbents)



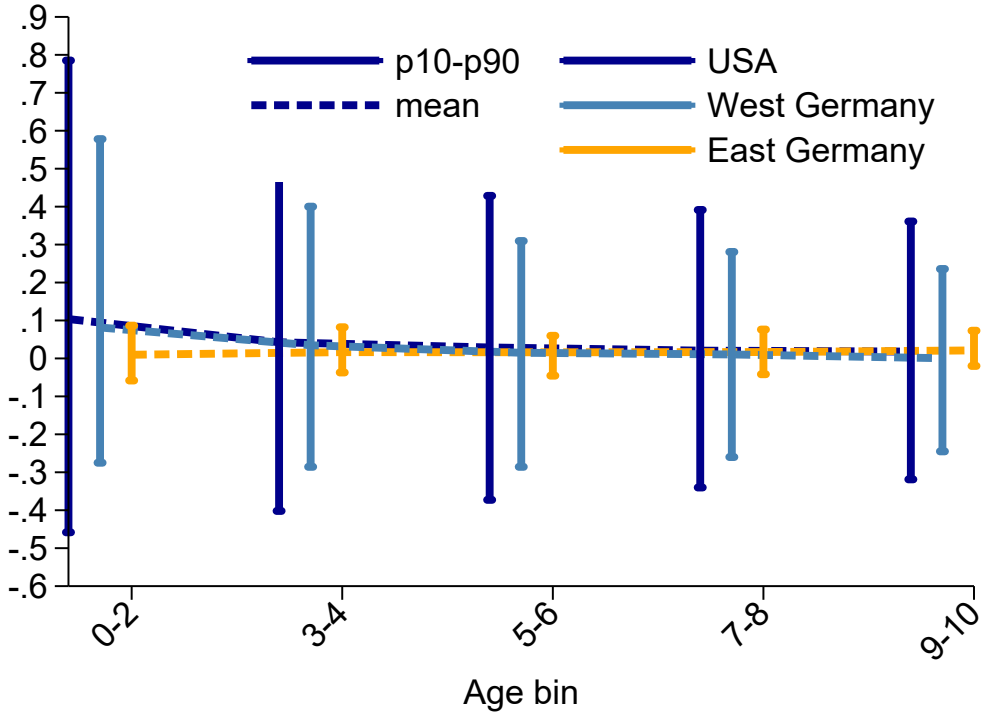
Note: Average values across several years: East Germany (yellow): 1983-1988, Soviet Russia (red): 1980 & 1989 , West Germany (light blue): 1980-1988, USA (blue): 1980-1988. Manufacturing sector. Job reallocation rate (Davis and Haltiwanger, 1992; Davis et al., 1998) is computed as $JRR_t = \frac{\sum_i |e_{j,t} - e_{j,t-1}|}{\sum_i 0.5(e_{j,t} + e_{j,t-1})}$, where $e_{j,t}$ is employment of firm i in time t only for survivors for comparability of the Russian data set with the other countries.
Data: USA: BDS, West Germany: IAB EHP, GDR: The Statistical Office of the GDR, Soviet Russia: The Central Statistical Directorate of the USSR The underlying numbers are presented in Table 5.

had the task to both guide the development of new technologies, and the introduction of the technologies to the existing plants. The next section documents the role of reallocation, selection, and growth of the more productive firms in the market economies and absence of such dynamics in the planned economies.

3.1.2 Experimentation and Selection over the Plant Life Cycle

In market economies, firms start small. They test their ideas in the market, learn about their productivity type, and compete with incumbents and other entrants. The firms with competitive ideas and high productivity survive and grow, while unproductive firms shrink and exit. The rate of growth of survivors shows the selection towards the highest performing firms. In the planned economy, the planner performs the role of the entrepreneur, or comes even closer to what might be considered a VC investor, i.e.they select projects, observe performance, and invest in promising new production technology. We can quantify the outcomes of these different forms of decision making by exploring the overall growth dynamics in the different economies. Specifically, we examine the dispersion of firm employment growth, the growth of surviving firms, and the share of small firms by age.

Figure 5: Employment Growth Dispersion by Firm Age Bin



Note: Employment growth by firm age (employment weighted). Employment growth is $g^e_{it} = \frac{e_{it}-e_{it-1}}{0.5(e_{it}+e_{it-1})}$, where e_{it} is employment of firm i in time t.
Data: USA (1996–2013): Haltiwanger et al. (2016), aggregated to the age bins, GDR (1985-1989): The Statistical Office of the GDR, West Germany: The Statistical Office of Germany

Figure 5 shows the distribution of employment growth rates by firm age.[4] In market economies, not only is the dispersion much higher compared to planned economies, but it is also higher for young firms and decreases with firm age. When young firms enter, they bring new ideas to market. Those that are successful grow, while those with non-competitive ideas shrink and exit. Dispersion decreases with firm age as a result of this selection process and as firms reach their optimal size.[5] These dynamics are altogether absent from planned economies. We note that in market economies dispersion in growth rates is still substantial even for seasoned firms. The employment (and revenue growth) can change up to 40%, which reflects the fact that the position of more established firms is constantly challenged by new ideas, technologies and business models in market economies. Firms can either keep up or shrink and exit the market.

For planned economies, the dispersion of growth rates is not only much smaller, but it is stable over the life cycle. Young firms do not compete for market dominance with their new ideas and technologies against other firms. Instead, the planner makes a decision regarding the need for a new firm (plant), its size, technology and output targets, and

[4]The graph is based on firm rather than plant level characteristics for consistency with the US results that are coming from Haltiwanger et al. (2016).

[5]The dispersion of revenue growth follows the same pattern, as reported in Figure 12 in Appendix B.

allocates resources required to reach these targets. The planner achieves their goals once the plant reaches its production targets. Plant managers do not have incentives to experiment and grow beyond the required targets.

Figure 6a follows Hsieh and Klenow (2014) and shows the life cycle growth for the average plant in our market and planned economies after both the plant and the firm have been founded simultaneously – as dicussed, we exclude new plants of mature firms since these are often the result of reorganizations (both in planned and market economies) and behave very similar to mature plants. We group cohorts according to their age. Plant size is normalized at the initial period. Establishments in market economies grow in size over the life cycle, exhibiting higher growth rates during the early years and slowing down as they age. Competitive pressure creates an up-or-out dynamic whereby less competitive plants shrink and exit, and resources are reallocated to more promising plants which can then grow. The steepness of the curve reflects the strength of the selection forces in the economy. We note that the growth pattern of the average plant in the US is steeper compared to the one for West Germany, suggesting stronger reallocation dynamics at play.

In planned economies the size of establishments does not change over the life cycle. Establishments' entry and size at entry is predetermined by the planner; not only is the entry rate very low, but also the entrants do not create competitive pressure on incumbents by design and do not aim for growth in size or market share.

Figure 6b shows how the the establishment size composition changes with establishment (and thus firm) age in market and planned economies. In market economies, most of the entering establishments are small, and hence the share of small establishments is largest in the youngest bin. As plants age, and due to selection and growth the share of small plants decreases. Still, even for the oldest age bin, there is a sizable fraction of small plants: either they did not manage to grow, or they shrank as they were challenged with competition from the newly entering firms.

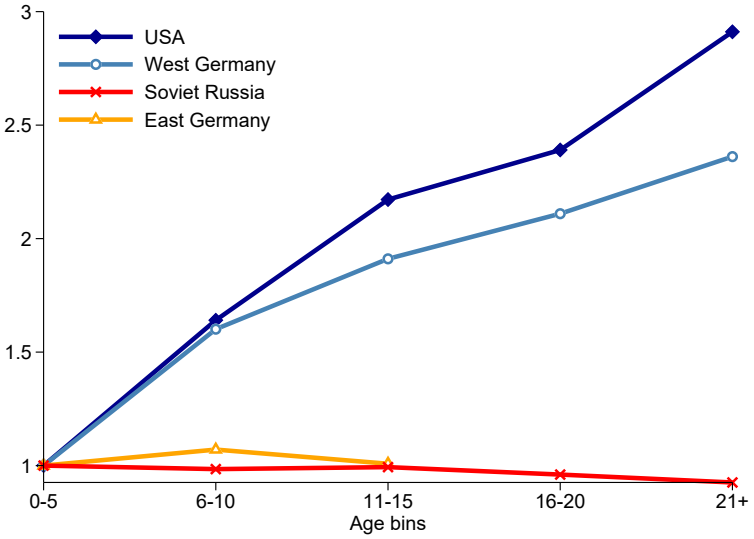
By contrast, in planned economies, the share of small plants is negligible and does not change with age. The majority of entering firms were large already at entry, and in the absence of competition they do not experience substantial changes in size and neither grow nor shrink. The difference between the two groups of countries is even larger than it appears due to the difference in scales in the chart.

3.2 Allocative Efficiency and Aggregate Productivity

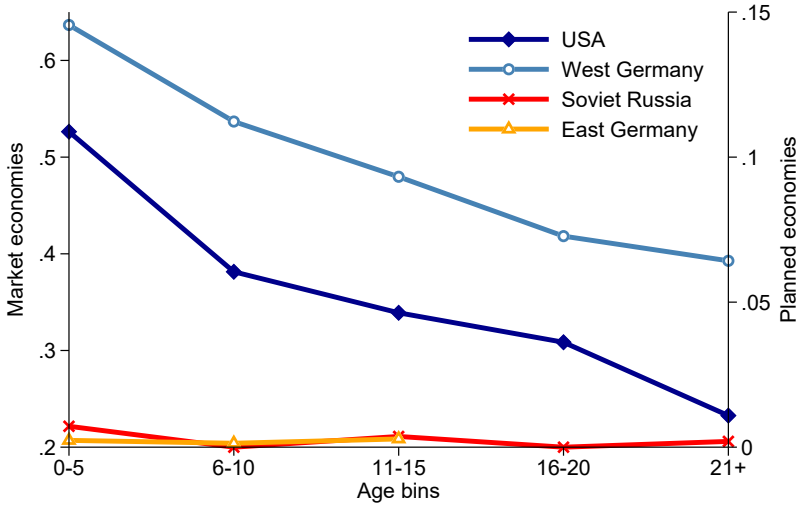
The stylized facts illustrate the negligible role that reallocation dynamics play in planned economies. All the decisions regarding a plant's size and productivity were predetermined by the planner at entry. Plants did not experience any sizable changes over the life cycle. A natural question is whether this lack of dynamism was because the planners allocated labor and technologies in the optimal way, and no changes were required over the course of

Figure 6: Selection over the Life Cycle

a) Establishment Life Cycle: Average Size by Age Bin



b) Share of Small Plants by Age Bin



Note: 6a: The graph reports the average size by age bin, normalized to the average size of the youngest bin, computed within age cohorts. East Germany: cohorts 1978-1983, USA and West Germany: every 5th cohort during 1978-2018. The line for Soviet Russia is constructed differently due to data limitations (9-year gap panel): the growth rate between age groups is approximated with the annual growth for each age cohort computed from the 9-year growth of each age cohort; based on that the cumulative growth over the age years is computed. The average cumulative growth by age bin is computed and normalized by the youngest bin's average cumulative growth. For the US the data for all the industries is used. The age of the plants is defined by the age of the firms to which the plants belong 6b Small plants are plants with less than 5 employees. The shares are computed for the following cross-sections: 1980 for Soviet Russia, 1986 for East Germany, 2012 for the USA and West Germany. For East Germany, entry year is defined as the first year in the sample if they enter after 1975 (the first year of the data set).
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East Germany), IAB EHP (West Germany), USA: US Census Bureau BDS (6a), US Census Bureau BDS (USA) reported in Akcigit et al. (2021) replication package (6b).

the plants' life cycle, or rather, whether planners did not react to suboptimal allocation. We perform a simple Olley-Pakes decomposition (Olley and Pakes, 1996) to shed light on this question.

For this and all following discussion, we move our analysis to the firm level: In the market economy, it is firms and not plants that maximize profit. In the planned economy, economic plans are made at the level of the firm and not the plant, too. Productivity and plan fulfillment are thus measured at the firm level. Of course, in both systems, most firms are single plant and the distinction does not matter for these units either way. We measure productivity as revenue based labor productivity mainly for comparability reasons. Our data sets of soviet Russia and Bartelsman et al. (2013), our source for the US, report revenue based labor productivity. However, the results do not change qualitatively when using value added based measures for the countries where we can do so.

Equation 1 shows the decomposition of aggregate productivity (weighted average productivity) into two components: the average productivity and the covariance term (the product of the deviation of employment share and productivity from the industry average), where Ω is the aggregate productivity, ω_i is the productivity of firm i, $\bar{\omega}$ is the average productivity, s_i is employment share of firm i, and N is the number of firms. A positive covariance term for firm i indicates a positive correlation between size and productivity. In other words, the higher the covariance term, the more labor is allocated towards more productive firms and the stronger is the correlation between productivity and size.

$$\Omega = \bar{\omega} + \sum_{i=1}^{N} (\omega_i - \bar{\omega})(s_i - \frac{1}{N}) \tag{1}$$

Table 2 shows the contribution of each term to the aggregate productivity for each economy. The contribution of the covariance term is very low for planned economies, which implies low correlation between size and productivity. As for the market economies, the pattern is consistent with previous stylized facts: allocation in the US is the most efficient among the four economies with 50% of aggregate productivity being explained by the allocation of labor towards more productive firms. West Germany falls again between the US and the planned economies with only 20% of aggregate productivity being explained by allocative efficiency.

Table 2: *Olley and Pakes (1996) decomposition*

	Planned economies		Market economies	
	East Germany 1986-1989	Soviet Russia 1986-1989	West Germany 2002-2010	USA 1993-2001
Average productivity	97.1%	91%	79.6%	49%
Covariance	2.9%	9%	20.4%	51%

Note: The table shows the contribution of the average productivity and the covariance of the size and productivity to the aggregate productivity. The contribution of the average productivity is computed as the weighted average across manufacturing industries weighted by sector employment.
Data: Soviet Russia: USSR manufacturing Census, GDR: plan fulfillment survey, East and West Germany: the IAB Establishment Panel, USA: Bartelsman et al. (2013)

3.3 Drivers of Reallocation Dynamics

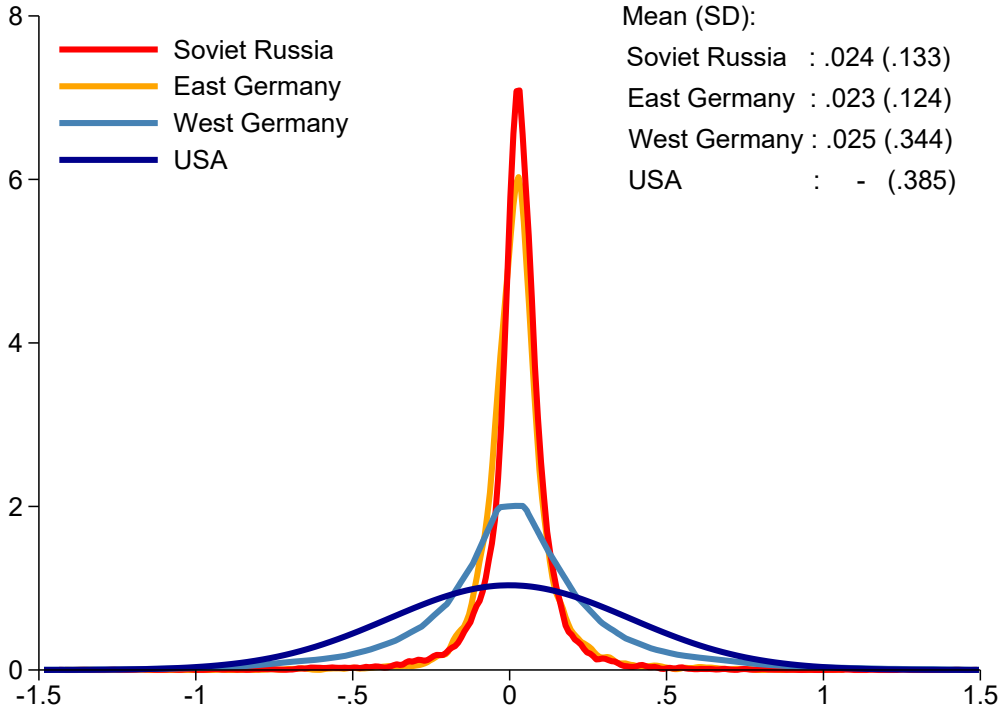
The stylized facts presented in the previous sections provide qualitative evidence of low reallocation dynamics in planned economies. Furthermore, the results of the Olley-Pakes decomposition indicate that the allocation of labor in planned economies was far from optimal. This raises the question of the potential sources of low dynamism. We follow Decker et al. (2020) and explore two possible drivers of low reallocation: muted productivity dynamics, and low responsiveness to those productivity dynamics from the part of the planner.

3.3.1 Productivity shocks

Productivity shocks reflect improvements in technical efficiency, for example, from firms' experimentation, the adoption of new production technologies or business models, as well as demand shocks from changing local conditions or tastes. From this perspective, the dispersion of productivity shocks reflects firms' occasions to adjust their operational size to maximize profits (or minimize losses).

Figure 7 shows the distribution of labor productivity shocks for the four economies and reports means and standard deviations of the distributions. While the average productivity shock is rather similar in planned and market economies, the dispersion is substantially larger in market economies. The difference in the structure of productivity dynamics lies in different incentive structures of two economic systems. In market economies, competition, and the up-or-out dynamics create incentives for innovation. Firms that want to survive and grow have to experiment and innovate, and are in turn challenged by the innovations introduced by competitors. In planned economies there is no direct competition between firms. The planner sets annual increases in output targets, and incentivizes innovation by offering plant managers bonuses for meeting those targets. However, the dispersion of productivity shocks was substantially smaller, as there was no incentive to deviate from

Figure 7: Productivity shocks in planned and market economies



Note: Firm level productivity shocks measured as the first difference in log real revenue productivity. US values are imputed from (Decker et al., 2020), see Appendix B for details. Years: GDR: 1985-1989, Soviet Russia: 1985-1987, West Germany: 2002-2010, USA: 1997-2013.
Data: GDR: GDR plan fulfillement survey, price deflator: own calculations; quality deflator: Heske (2005) ; USSR: Brown et al. (2006) (in const. prices), quality deflator based on Ponomarenko (2001) ; West Germany (inflation adjusted): the German Statistical Office

target. On the contrary, the deviation in either direction would be punished either via loss of bonuses or via higher targets for the next period - the "ratchet effect", discussed in Section 2.1.

Our data offers us the first chance to actually test the ratchet effect empirically. The GDR dataset contains quarterly and yearly plan targets for industrial revenue and actual output. We can thus observe how these plans change in response to positive or negative shocks. To test this, we estimate the change in plans after a firm deviates from its target. Specifically, we estimate

$$Y_t = \beta_P \frac{R_t}{R_t^P} \tag{2}$$

where $\frac{R_t}{R_t^P}$ is the ratio of revenue in year t, and planned revenue for that same year at the start of year t. Y_t stands for three different planning outcomes: planned revenue for t at the end of t, i.e. after eventual plan changes during the year, planned revenue for $t+1$ at the start of $t+1$, i.e. the plan made at the start of the next year, and planned revenue for $t+1$ at the end of $t+1$. This shows the planning response both for the "aspirational" plans at the

start of the next year and for the end of year plans determining bonus payments. Table 3 reports the results from this estimation.

Table 3: *Ratchet Effect in the GDR*

	Plan change after a firm exceeds the plan		
	within year 1985-1989	start of next year 1985-1989	end of next year 1985-1989
year=1985 $\times \frac{R_t}{R_t^P}$	0.719***	0.639***	0.810***
	(0.025)	(0.060)	(0.060)
year=1986 $\times \frac{R_t}{R_t^P}$	0.471***	0.627***	0.771***
	(0.172)	(0.040)	(0.039)
year=1987 $\times \frac{R_t}{R_t^P}$	0.487***	0.621***	0.824***
	(0.026)	(0.042)	(0.044)
year=1988 $\times \frac{R_t}{R_t^P}$	0.590***	0.604***	0.839***
	(0.031)	(0.105)	(0.035)
Observations	13239	13237	13239
R^2	0.16	0.12	0.20

Notes: standard errors in parentheses. Explanatory variable is the ratio of actual to planned industrial revenue at the end of the calendar year, interacted with the year. 1% higher revenue leads to roughly 0.6% higher targets in the same year, 0.6% higher targets at the start next year and 0.8% higher targets at the end of next year.

Evidently, the planner adjusted his plans upwards substantially in response to plant success: between 70% and 50% of plants' productivity increases would not have affected bonuses, since the plan was adjusted in the same year. Managers could expect their next year's plan to increase by 60% over the total amount exceeded. However, during the following year, the planner would further increase the target by an additional 20%. Thus, a manager introducing a successful innovation could expect 60% of the theoretically appropriate bonuses to never be paid out and another 20% to be lost after 1 year. As such, the ratchet effect was extremely strong in the GDR and any occurring innovation should probably be attributed to non-monetary motivations (at least from 1985-1989, the years for which we have data).

3.3.2 Reallocation in Response to Productivity

Models of firm dynamics show firms adjust their labor demand, and thus hire and fire workers, in response to a productivity shock. Both the market and the planner should real-

locate resources towards firms that have become more productive (and potentially remove them from firms that have become less productive). The size of the shocks and the speed of the response are key determinants of labor reallocation and aggregate productivity growth. Decker et al. (2020) provide both an estimate of the importance of this channel in the US economy and an estimation framework to use on other countries. We apply their framework to our economies. Specifically, we estimate the parameters for productivity persistence and responsiveness. Productivity persistence is estimated as an AR1 process as follows:

$$a_{j,t+1} = \rho a_{j,t} + \Theta_{s,t} + \varepsilon_{j,t} \tag{3}$$

where ρ measures the degree to which this year's productivity predicts next year's expected productivity $a_{j,t}$, $\varepsilon_{j,t}$ are random productivity shocks and $\Theta_{s,t}$ is sector-time fixed effects. Throughout this analysis, firm productivity $a_{j,t}$ is measured as the log deviation of revenue productivity from the sector mean. Thus, a low ρ means that firm productivity has a strong tendency to revert to the sector mean. A productivity advantage that a firm holds this year does not predict a strong productivity advantage next year. Aggregate productivity dispersion is maintained by new entrants and the size of the random shocks $\varepsilon_{j,t}$, which randomly create new leading and lagging firms. Without these shocks, all firms would eventually converge to $a_{j,t} = 0$, i.e. the average firm productivity in the sector. The interplay between these three forces determines aggregate productivity dispersion and thus also the scope for reallocation. The estimate is agnostic as to the exact mechanisms behind this regression towards the mean. E.g. unproductive established firms could learn new business practices and thus close the gap to the sector while young and innovative firms lose their relative edge to the sector by technology diffusion.

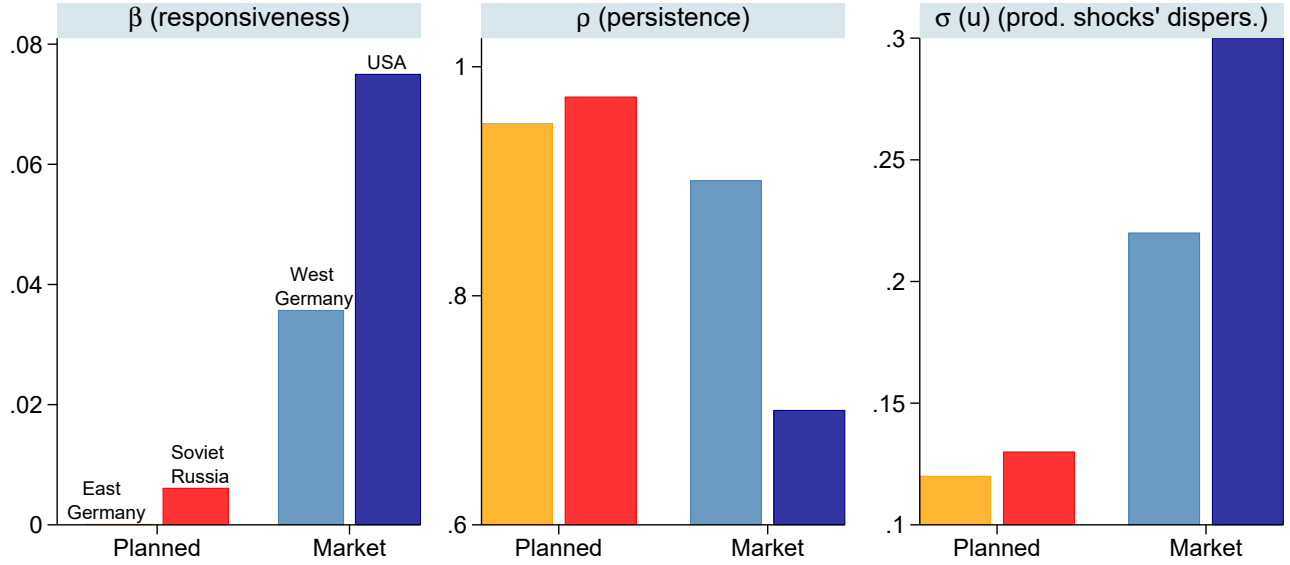
Firms' responsiveness to their realized productivity shocks is estimated as follows:

$$g(l)_{j,t+1} = \beta a_{j,t} + \gamma l_{j,t} + \Theta_{s,t} + u_{j,t} \tag{4}$$

where $g(l)_{j,t} = \frac{l_{t+1} - l_t}{0.5 * (l_{t+1} + l_t)}$ is a bounded measure of growth as defined by Davis et al. (1998), $a_{j,t}$ is productivity in period t, and $l_{j,t}$ is employment at time t. Despite being measured in the same year, there is a timing difference between $a_{j,t}$ and $l_{j,t}$, since productivity is computed with end of year revenues, while employment is measured during a specific time in the year (in most of our data sets, around summer). Intuitively, the underlying assumption is that firm j was at its equilibrium employment at time t, taking into account its productivity at time t, and β measures how it responds to the new productivity draw $a_{j,t+1}$. We follow the empirical specification for revenue labor productivity as in Decker et al. (2020) regarding productivity measurement, control variables, and timing of variable measurements and estimate the responsiveness of planned and market economies for the years in our sample economies.

Figure 8 reports the results for each country. Planned economies are outliers in both

Figure 8: Productivity Shocks and Firms' Responsiveness



Note: Unit of observation: harmonized firm identifiers. USA results: persistence as reported in (Decker et al., 2020) (estimated for 1997-2013), responsiveness as reported in Blackwood et al. (2024)
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East-Germany), IAB EHP (West-Germany), US Census Bureau BDS (USA) Preferred data sources for individual countries are discussed in section 2.3 and in even more detail in Appendix A.

productivity persistence (which is very high) and responsiveness (which is very low). The high productivity persistence and low productivity shocks of planned economy firms might be convenient for a social planner, but they also imply that the differences between firms are small and there are limited opportunities to exploit them via reallocation for large productivity gains. This is concurrent with the responsiveness picture, where the social planner does not have a statistically significant response to productivity. Even though West Germany is much less dynamic than the US, substantial responses to productivity shocks are estimated for both market economies.

Since we observe the productivity evolution, we can compute the drag the lower responsiveness had on planned economies. We estimate the counterfactual aggregate productivity growth had the social planner reallocated employment as fast as the US economy.[6] We find that US level responsiveness levels from the same period would have generated increases in aggregate productivity of 1.5% per year in Russia. These gains are substantial, but lower than the loss in productivity from declining responsiveness estimated for the US economy in more recent times (Decker et al., 2020). The reason for this is that productivity dispersion is lower in planned economies in general, which limits potential gains from reallocation.

To estimate the long term gains to productivity, from different margins of adjustment we

[6]We predict employment growth in Russian manufacturing firms assuming the same responsiveness parameters for US firms. With predicted employment values and their realized productivity we can estimate the counterfactual productivity.

now simulate the East German and Russian economy with different responsiveness, entry and exit parameters in section 4.

4 Counterfactual Simulations

4.1 Simulation Setup

Section 3 documented stark differences in firm behavior and reallocation between planned and market economies. Many aspects of business dynamism are either much weaker or absent in planned economies. This makes them an interesting counterfactual to market economies when studying the effects of different channels of reallocation. Our strategy is to start with the observed manufacturing firms in 1980, and simulate the economy with the different parameter values estimated in West Germany, the US, East Germany and Russia. Specifically, equation (3) describes the productivity shocks that firms experience each period, and equation (4) describes firms' labor responses to these productivity shocks.[7]

The entry of new firms is characterized by the entry rate, and average size at entry, while the exit rate, and the relationship between exit and productivity describe exit behavior. Specifically, we estimate the following exit equation:

$$D^{exit}_{j,t+1} = \beta a_{j,t} + \gamma l_{j,t} + \Theta_{s,t} + u_{j,t} \tag{5}$$

where $D^{exit}_{j,t+1}$ is a dummy that is defined as 1 if the firm exits next year. We draw a productivity, and employment shock from the appropriate sector size class bin.

Our general strategy is to take the current firm population (starting from the Russian and GDR manufacturing sector in 1980) and produce counterfactuals by predicting next year's employment, productivity, and exit for these firms with the above equations, borrowing parameters from West Germany, and the US. In addition, we simulate firm entry using the entry rate and average size of the US and West German economies respectively. In this way, our simulation procedure yields productivity and labor demand for all firms in the economy. However, this ignores the labor market equilibrium effects of firms' decisions. Consider a case where all firms randomly draw positive shocks and thus aim to grow. However, in our empirical framework, the equilibrium wage in the economy is part of the estimated fixed effects. To bring labor demand and supply in line, we therefore adjust the constant of the responsiveness equation to keep total labor constant.[8] This yields the final joint distribution of firm size and productivity, from which we can compute aggregate productivity as

$$A_{i,s,t} = \sum a_{i,s,t} s_{i,s,t} \tag{6}$$

[7] See Section 3 for a detailed discussion of these equations.

[8] While the notion of an equilibrium wage might seem foreign to planned economies, labor was allocated similarly in these economies (Gregory and Stuart, 1986). Regardless of the system, the employment supply contraint must hold either way.

where $s_{i,s,t}$ is the share of firm i in sector s at time t and $a_{i,s,t}$ is the productivity log deviation from the sector mean. Aggregating in this way ignores the productivity differences between sectors. Thus, our productivity measure focuses on within-sector reallocation and ignores Schumpeterian creative destruction from the reallocation of resources across industries. It is worth noting that planned economies had a different sector allocation, and that we largely ignore this potential cause of inefficiencies.

4.2 Decomposition of aggregate responsiveness differences

In market economies, older and larger firms are less responsive to shocks. Such firms abound in the planned economy (Figure 2) due to extremely low entry and exit rates and the substantial size of the entering firms. Thus, the aggregate differences in reallocation and responsiveness in Section 3 are in some part due to the different firm size and age distribution prevalent in Russia and the GDR. To disentangle the two, we estimate size class and firm age specific parameters of the responsiveness and persistence parameters in Section 3.

We now estimate persistence as:

$$a_{j,t+1} = \rho_{z,age} * a_{j,t} \times \Gamma_{z,t} \times D_{age \geq 5} + \Theta_{s,t} + \zeta_{j,t} \tag{7}$$

where $\Gamma_{z,t}$ is a firm size class dummy, and $D_{age \geq 5}$ is a dummy denoting firms younger than 5 years. This follows the familiar structure, but allows $\rho_{z,age}$ to vary with age and size class. We also estimate firms' responsiveness to these productivity shocks as:

$$g(l)_{j,t+1} = \beta_{z,age} * a_{j,t} \times \Gamma_{z,t} \times D_{age \geq 5} + \gamma * l_{j,t-1} \times \Gamma_{z,t} \times D_{age \geq 5} + \Theta_{s,t} + u_{j,t} \tag{8}$$

which effectively allows responsiveness to vary between age and size groups. Ex ante, we would expect young firms in market economies to be more responsive to productivity, especially with exit. Given our parameterization, we can interpret β roughly as the percentage change in employment.[9]

We are unable to perform such a regression for the US, therefore, we impute the US results from the published regressions of Blackwood et al. (2024), and Decker et al. (2020) and use a Weighted Least Squares intuition to assign responsiveness and persistence to the different groups. We affix the ratio of responsiveness between the different groups so that they mirror the ratios between the job reallocation rates of continuers in the US between 1980 and 1989 (as published in the BDS) and that the employment weighted mean beta equals that estimated for the 1980s manufacturing sector in Blackwood et al. (2024). For exit responsiveness, we follow the same strategy, but use the job reallocation rate due to exit and target the manufacturing exit responsiveness reported in Decker et al. (2020).

[9]This is not strictly correct for surviving firms, since our left hand variable is DHS employment growth (Davis and Haltiwanger, 1992), which is only approximately equivalent to percentages if changes are not too large.

Figure 9 reports the results from estimating equation (8). There are striking differences between planned and market economy firms, even for firms within the same group, especially for young and small firms. Young, small firms in market economies are much more responsive (US young firms have much higher job reallocation rates) than their planned economy counterparts. There is also a substantial size gradient, i.e. smaller firms are more responsive in market economies. In planned economies, the size gradient is extremely small and the difference between young and old firms cannot be estimated in a reliable way since there are so few young firms.

There are also substantial differences between the market economies. The US has higher entry and exit rates. And while exit rates in West Germany are still higher than in planned economies, the responsiveness of exit to productivity is basically zero as well. Since exit does not respond to productivity, the productivity gains from firm exit are limited. The lower responsiveness of employment and exit explains, in part, the lower allocative efficiency in West Germany compared to the US, but both market economies differ markedly from the planned economies we observe. The exceptional exit responsiveness of the US highlights the strength of the 'experimentation and shakeout'-process (Cunningham et al., 2021) in the US.

4.3 Counterfactuals of Interest

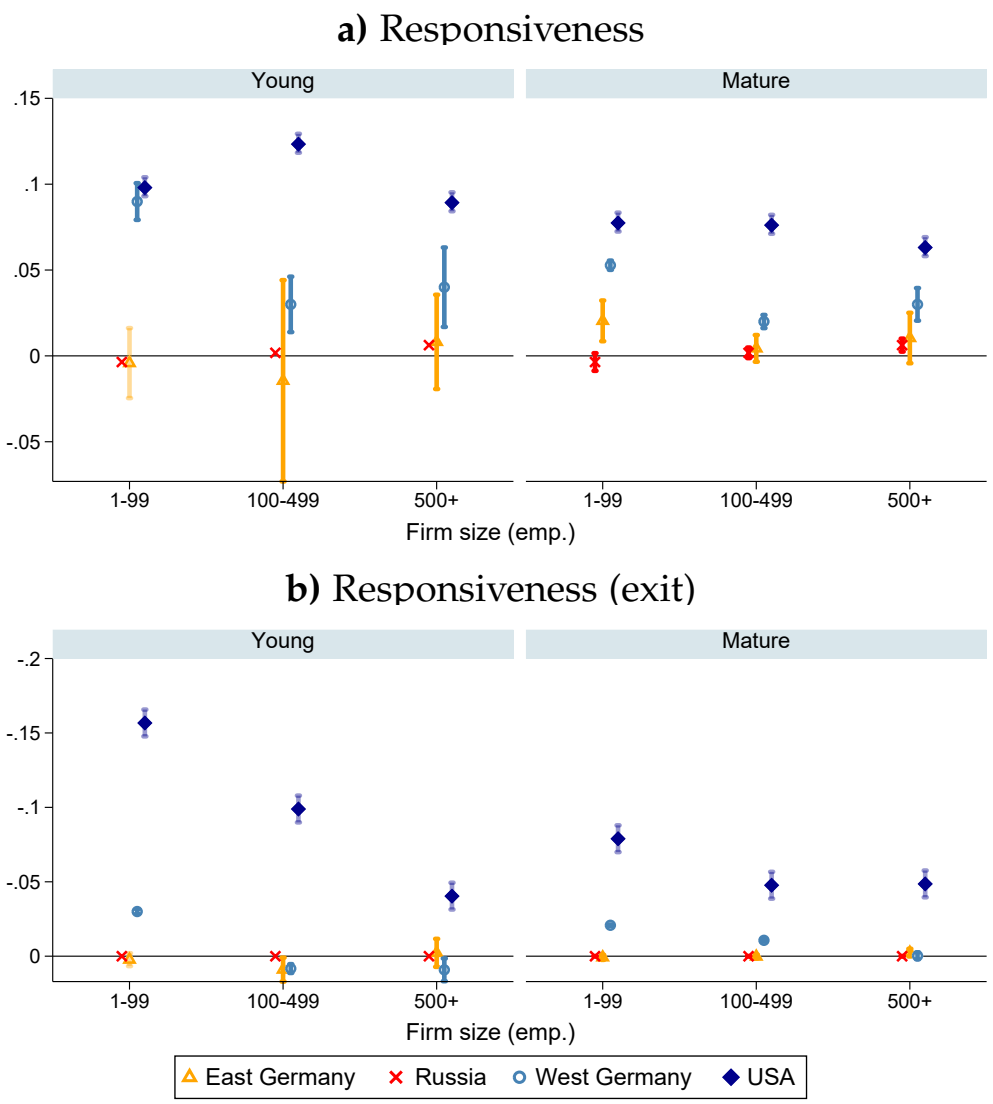
4.3.1 Counterfactual A: Responsiveness of incumbents

Increasing the responsiveness of existing firms is potentially the least disruptive change we can hypothetically introduce in planned economies, given that planners are already supposed to reallocate resources to increase production. In this counterfactual, we simulate the effect of switching the responsiveness estimates for surviving firms in our planned economies; Russia and East Germany, to those of the market economies; US and West Germany. However, we keep firm entry, and exit to their observed levels. This excercise explores the impact on aggregate productivity purely from the more efficient reallocation of labor across existing firms. Switching to the US responsiveness profile should lead to substantial productivity gains. While most firms in the planned economies are large and old, these firms are still reasonably responsive in the US and their employment decisions have substantial productivity implications.

4.3.2 Counterfactual B: Entry of New Firms

Entry is an order of magnitude less common in planned than in market economies and makes a negligible contribution to productivity. While potentially challenging to established firms, entry in itself need not be threatening to the overall structure of the economy in a planned system where the planner controls the exit decisions of incumbents. We thus consider a policy that creates market economy levels of entry next. Market economies rely

Figure 9: *Simulation Parameters*



	Soviet Russia	East Germany	West Germany	USA
Employment share (age =0)	0.15%	0.05%	.7%	1.2%
Firm size (age =0)	359	114	3	10
$corr(u_{j,t}; \zeta_{f,t})$	-0.12	-0.58	-0.32	-

Notes: Statistics marked with "-" cannot be estimated
Source: manufacturing census of Russia & the GDR, business registry of West Germany, US manufacturing census and Decker et al. (2020) for US

on entry of firms for a substantial share of the creation of new technologies. To capture this effect, we create cohorts of newly entering firms that enter with a randomly drawn productivity and a representative size and then behave according to their age as described in Figure 9.

Entering firms made up on average 1.2% of employment in the US of the 1980s, and 0.7% in West Germany of the 2000s (unfortunately firm entry data for Germany only exists from 2002 onwards). Average firm size at entry varies across market economies, (10 in the US 1980s and 1990s according to BDS, and 2.6 in Germany, (Anyadike-Danes et al., 2014)). However, it is two orders of magnitude smaller than in planned economies, where new plants are a rare occurrence and the result of a central decision.

On average, entering firms do not have markedly higher productivity than the average firm in their sector. Thus, without additional reallocation or exit, the contribution of entry to productivity is low. However, after entry, firms react faster to productivity and exit much more frequently. After a few years, the new cohort will have higher average productivity because of exits and even higher aggregate productivity because of employment shifting to the most productive firms (Foster et al., 2001; Baily et al., 2001; Pancost and Yeh, 2022). If new cohorts raise the average firm productivity in their sectors this way, they even have an indirect effect on the incumbents, since all firms' productivity trends towards the (now higher) sector mean. This might be interpreted as the competition effect of entry, which is predicted theoretically and well documented for new foreign competition empirically (Bernard et al., 2006; Aghion et al., 2009; Bloom et al., 2016; Bräuer et al., 2023).

4.3.3 Counterfactual C: Exit of Incumbents

Schumpeterian destruction of incumbents is a central driver of market economies' efficiency gains (Foster et al., 2001). It is also a radical departure from the planned system, where plants virtually never exited due to inefficiency and the state guaranteed employment to every worker. Thus, it is our last counterfactual scenario. Switching the responsiveness of exit and the exit rate of firms to market economy levels should contribute substantially to reallocation and productivity growth. The large and mature firms that are typical for planned economies are not very likely to exit in market economies, either. Nevertheless, since there are many more very unproductive and still large in the planned economy, substantial shares of employment can be reallocated if they gain at least some exit probability. Their exit not only improves the allocation of labor between incumbent firms, but also shifts more labor to the surviving entrants, which are on average more productive. Lastly, letting unproductive incumbents exit improves the sector averages, which leads to small productivity gains across all firms in our model.

4.4 The Macroeconomic Effect of Responsiveness

Figure 10 reports simulation results starting from the earliest available micro data for each country. Panels 10a and 10c report our counterfactuals starting with the 1980 Russian manufacturing sector and Panels 10b and 10d for the GDR. Generally, the two starting scenarios yield very similar pictures:

Notably, productivity declines in the baseline scenario, i.e. with the parameters estimated for planned economies. While shocks are smaller in planned economies, they still occur (standard deviation of shocks is circa 12% of sector mean) and without any reaction by the social planner, they introduce additional noise into the relationship between size and productivity. This leads to slowly eroding allocative effciency, in line with what we observe in the data. This trend is exacerbated by the negative correlation between employment and productivity shocks in all economies, which also worsens allocation. A baseline responsiveness is necessary to counteract this, which both planned economies lack. The simulation (and evidence) is consistent with a scenario where the planned economies took over a portfolio of firms, but let allocative efficiency and productivity dispersion decline over time.

US responsiveness of incumbent firms leads to substantial productivity gains. Since large and unproductive firms are numerous in planned economies, increasing reallocation away from them opens up large productivity gains. After 10 years, the higher responsiveness economy outperforms the baseline by 10% (GDR) to 12% (Russia).

In contrast, increasing firm entry to the US levels does not lead to relevant additional growth. The negative effects (allocating ressources to firms with random productivity) and the positive effects (increased reallocation within this group, increasing average firm productivity) roughly cancel each other out.

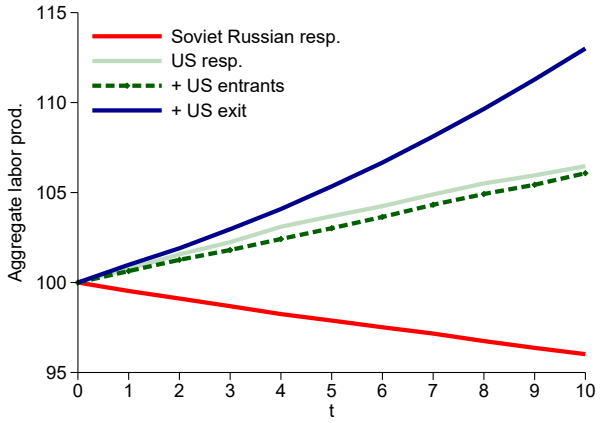
Allowing incumbent firms to exit with the US responsiveness and with US rates increases productivity substantially again. It shifts employment since there were originally more large and unproductive firms than in a market economy. Their employees move to productive incumbents and the productive newly entering firms, leading to 7% (Russia) or 8% (GDR) additional growth.

All in all, switching towards US responsiveness parameters yields a productivity increase of 1.8% per year, both in Russia and in the GDR, accounting for almost the entire productivity growth gap between these economies.

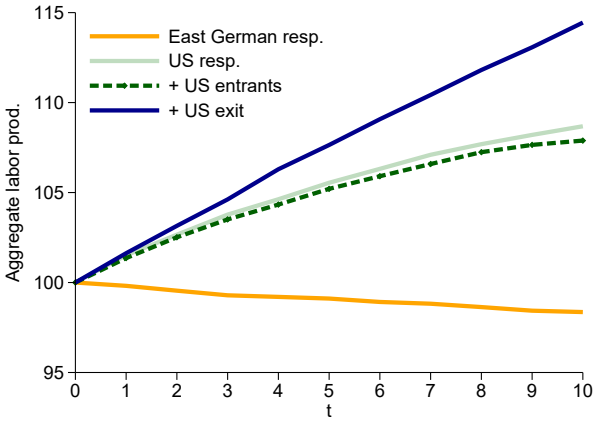
5 Conclusions

Our paper studies the effect of business dynamism and factors reallocation on growth using the planned economies of the communist system as case studies. Their entry, exit, and reallocation rates are much lower than what can be observed in market economies. In so doing, we first describe the economic history of the US, Russia, West Germany and communist

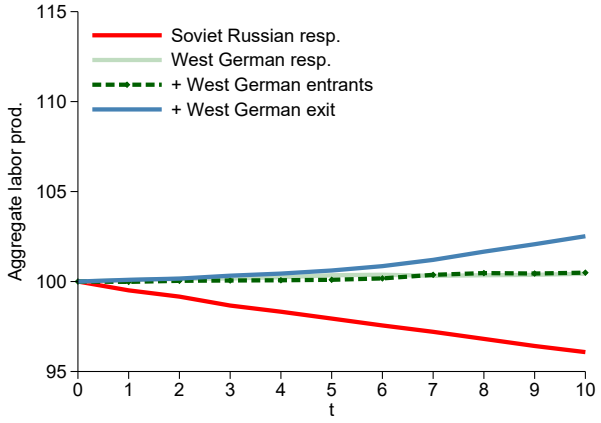
Figure 10: *Simulation Results: Aggregate Labor Productivity of Planned Economies with Market Economy Responsiveness and Firm Dynamics*



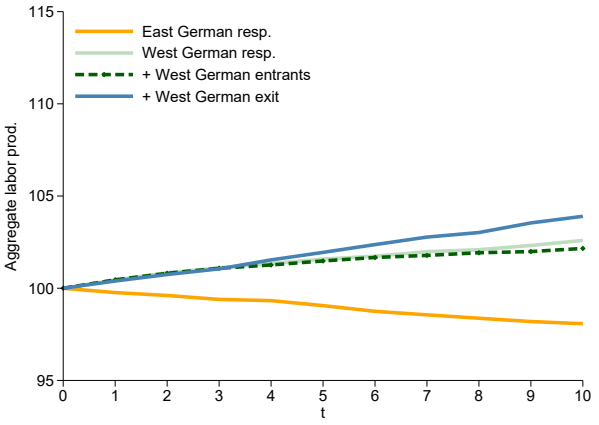
a) Russia 1980



b) East Germany 1980



c) Russia 1980



d) East Germany 1980

Notes: Simulation study of the effect of different responsiveness parameters on aggregate productivity. Initial firm distribution and productivity shock distribution as in Soviet Russia or the GDR in 1980 (aggregate productivity set to 100). We gradually switch responsiveness parameters to those of market economies (US in the top row and West Germany in the bottom row). Firms' responses to productivity shocks (1) as in the respective planned economy, (2) instead, using the market employment responsiveness, (3) additionally, with firms entering with the market economy rate and responsiveness parameters (4) also using market economy exit responsiveness. *Sources*: For a detailed description of the data sources, see section 2.3.

East Germany from 1980 to 1990 in terms of business dynamism, using firm level indicators popularized by the literature. We use these results to simulate counterfactual planned economies with some market economy characteristics to understand how much these characteristics contribute to growth. The most important channels are the responsiveness of firms to productivity and the exit of unproductive firms.

We estimate that Russia and East Germany both lost circa 7% of productivity growth between 1980 and 1990 due to not having US firm entry and exit behavior and circa 11%

due to existing firms' very low responsiveness to productivity (compared to the US). This holds even though firms are very large in planned economies and such firms are the least responsive firms in market economies. The productivity contribution of entry is through its interplay with exit: the immediate culling of unproductive entrants creates growth both by reallocating labor to the productive surviving entrants and by exerting competitive pressure on incumbents. Together, responsiveness and exit explain most of the failed convergence between planned and market economies.

We have applied our new counterfactual methodology to measure the importance of different business dynamism and reallocation margins using the planned economies of Russia and the GDR of the 1980s and 1990s. However, we see the spectrum between planned economies and the US economy as a continuum with these two systems as examples of edge cases. As such this same methodology can be used to explore the impact that market frictions and regulations have on overall productivity growth in other economies in the current context.

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Appendices

A Detailed Source Description

A.0.1 Russia (USSR)

The 1980 summary tables with information of about 22,000 firms are preserved in about a hundred archival files that we manually digitized. The coverage of this cross-section is the highest; it includes all firms that Soviet statistical agencies included in the 1980 summary-table. Missed firms are still possible, e.g., if a firm submitted its annual report with a delay, but hardly exceed 5-7 percent. There are 23.500 firms in our 1980 cross-section, and Soviet official statistical volume reports 25.000 firms in 1980. The major systematic limitation of this dataset that it does not include classified firms (military production and related sectors), information on which is still not available for public in the Russian archives. The dataset contains roughly 75% of manufacturing overall.

To describe the planned economy of Russia during the USSR, we combine several data sets. First, we use 1980 and 1989 summary tables with firm-level information on inputs (capital and labor) and output prepared by the Soviet Central Statistical Office each year on the base of firms annual reports.

For 1980, we extract such tables for industrial enterprises in the Russian Soviet Socialist Federation from the Russian State Archive of Economy. The 1980 summary tables with information of about 25,000 firms are preserved in about a hundred archival files that we manually digitized. The coverage of this cross-section is the highest; it includes all firms that Soviet statistical agencies included in the 1980 summary-table. Missed firms are still possible, e.g., if a firm submitted its annual report with a delay, but hardly exceed 5-7 percent. There are 23.500 firms in our 1980 cross-section, and Soviet official statistical volume reports 25.000 firms in 1980. The major systematic limitation of this dataset that it does not include classified firms (military production and related sectors), information on which is still not available for public in the Russian archives. The dataset contains roughly 75% of manufacturing overall.

For 1989, we use the 1989 dataset which is likely a copy of the 1989 summary tables shared with general public after the collapse of the Soviet Union. However, exact documentation is missed. We randomly check this dataset against the 1989 summary tables preserved in the the Russian State Archive of Economy. Figures are the same but firms belonging to particular state ministries (namely, Society of blind, society of deaf and ministry of public services to population) are missed. The missed firms do not exceed 7 percent.

In both 1980 and 1989 cross-sections, information is available at the firm and conglomerate level ("production association"). The data contains employment, average wage, capital, revenue, industry according to USSR classifications and location either at city or for firms in the countryside at the district level, but no registry numbers. For 1980 cross-section, we also know the year of birth for firms younger than 20 years. Thus, we link firms in the 1980 and 1989 cross sections through a combination of string matching and manual merging described in more detail in Appendix

A.0.2 East Germany

After Unification in 1990, the German Federal Archive inherited the microdata stored in the archives of the GDR, the socialist state set up in East Germany after the 2nd World War. Since the planned economy relied on substantial statistical knowledge, this data is quite comprehensive. In addition to the standard tasks of a statistical office, the GDR statistical offices were also responsible for controlling the implementation of the 5 year plans and conducted extensive data collection related to this. Most important for our purpose are the firm registry, the firm employment survey, the firm production survey and the firm plan accounting[10]. Together, these four surveys form our data set. The data covers 100% of emplyoment in the GDR economy, but the firm production survey and the firm plan accounting are subsamples that we reweight using estimated probability weights.

The registry information yields sectors, locations, the responsible planning agency and other meta information. The registry information was saved for every year after 1980. The employment survey contains information on the number of employees per firm and plant, their demographics, their wages and their medals and decorations for exceptional work. It was saved for the years 1975, 1980 and every year after 1983. It covers 100% of official GDR employment between 1975 and 1990. Quarterly plan accounting and production data start in 1985 and only cover a subset of firms which the GDR central planners deemed of special importance. For this subset of firms (roughly 45% of employment) we observe production inputs, outputs, profits, plan targets and plan fulfillment.

The GDR statistical office provides three different identifiers with this data, roughly corresponding to the address, the firm and the firm group. The decision making unit roughly equivalent to the firm or plant (called "plant registry number") is reporting the data for its sub units and also reports its affiliation to a larger conglomerate. The managers of these units were responsible for plan fulfillment and reported either directly to the appropriate ministry or to a large conglomerate consisting of multiple firms. E.g. the car manufacturing combine "IFA" maintained 40 firms spread across the GDR. One of these firms was "BARKAS", which reported employment, revenues and plans to the statistical office to give account for its use of resources. The "BARKAS Plant Nr. 1" plant in Chemnitz is the main adress associated with this firm, with separate assembly lines for engine and van assembly. The "plant registry number" is most comparable to market economy data. Conglomerates would be comparable firm groups according to the Eurostat definition, but these are not available for our period of interest. The adresses reported in the GDR data are much more granular than any plant data in market economies (e.g. they contain consecutive numbers on the same street) and lack time consistent identifiers.

During the transition to a market economy (1990-1994), planned economy firms were put under the supervision of the "Treuhand", mandated to privatize its firm portfolio as fast as possible and restructure where it was necessary to achieve a sale. The "Treuhand"'s files have become declassified with the 30 year anniversary of unification and we are among the first papers to use them to characterize the firm dynamics of the East-German transition period.

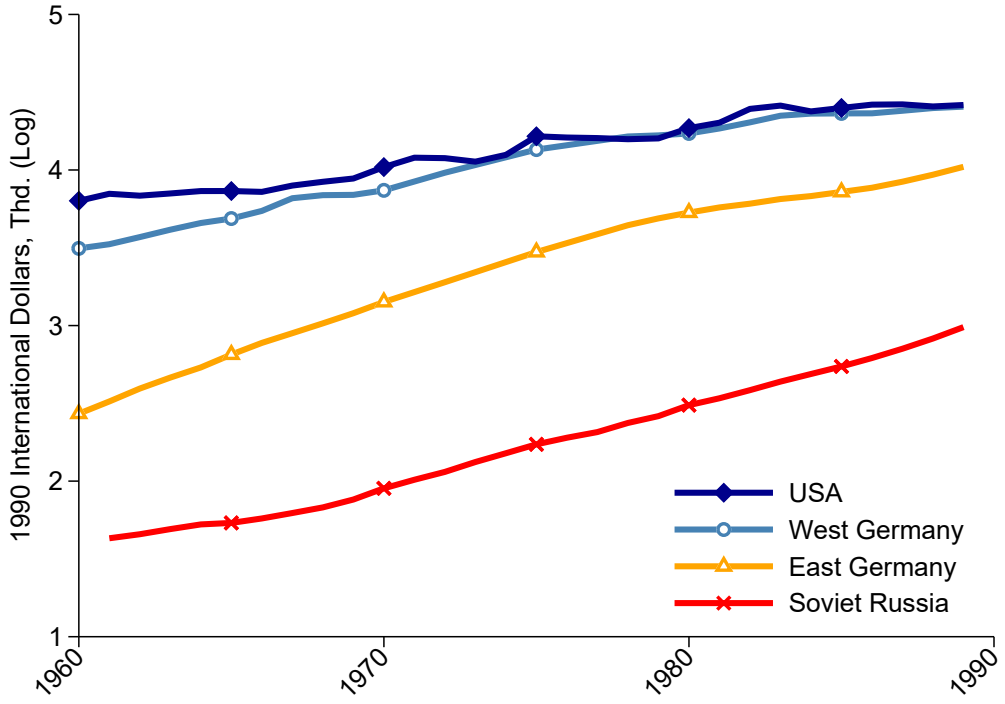
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[10]Signatures DE2-MD 083, DE2-MD 028, DE2-MD 016 and DE2-MD 018, respectively.

to the chaotic nature of the transition and the many split-offs and mergers of firms, we do not use this data for entry and exit analysis, but we are reasonably confident in our estimates for reallocation rates and responsiveness of firms that continue to exist, especially after augmenting and crosschecking the data with two other incomplete firm data sets of the time: The "Hoppenstedt" data set is our digitzation of a privately maintained firm regsitry of East-German firms that was sold to West-German businesses for the purpose of finding business partners in newly opened East-Germany. It contains registry numbers, addresses, revenues, employees and short histories for its roughly 10.000 entries per year. We use the 1991,1992 and 1993 years and merge them to our data set to cross-check exit, entry and employment numbers. We also use the survey that private polling firm SOESTRA conducted for the IAB research institute among East-German firms about their employment situation, business plans and relationship to the Treuhand between 1990 and 1996. Throughout the rest of our paper, we refer to the combined data product as the "Treuhand" data, since the majority of the information comes form this first data set.

B Additional Tables and Figures

Figure 11: Industrial Capital per Worker



Note: Germany and Soviet Russia: manufacturing, mining and utilities. USA: manufacturing. The series are converted to 1990 International Dollars: the conversion rates are the ratio of the GDP of countries in the currency of the data sources and the GDP in 1990 International dollars from the Maddison Project Database 2010

Data: East and West Germany: Heske (2013) , Soviet Russia: Voskoboynikov (2021) and the *The Statistical Year Book of Russian Federation 2005 (Rossijskij statisticheskij ezhegodnik. 2005)* (2006) , USA: data: NBER manufacturing industry database, deflator: FRED.

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Table 4: *Decomposition of Industrial Output Growth: Yearly Average (1960-1989)*

	Planned Economies		Market Economies	
	East Germany	Soviet Russia	West Germany	USA
	Yearly Average (1960-1975)			
Industrial Output	2.46%	5.41%	3.34%	3.47%
Among which:				
TFP	-.23%	1.89%	2.61%	1.54%
Capital	2.42%	2.13%	1.21%	1.54%
Labor	.27%	1.39%	-.48%	.39%
	Yearly Average (1976-1989)			
Industrial Output	.94%	1.56%	1.85%	3.13%
Among which:				
TFP	-.65%	-.33%	1.37%	1.62%
Capital	1.4%	1.83%	.6%	1.06%
Labor	.2%	.07%	-.12%	.45%

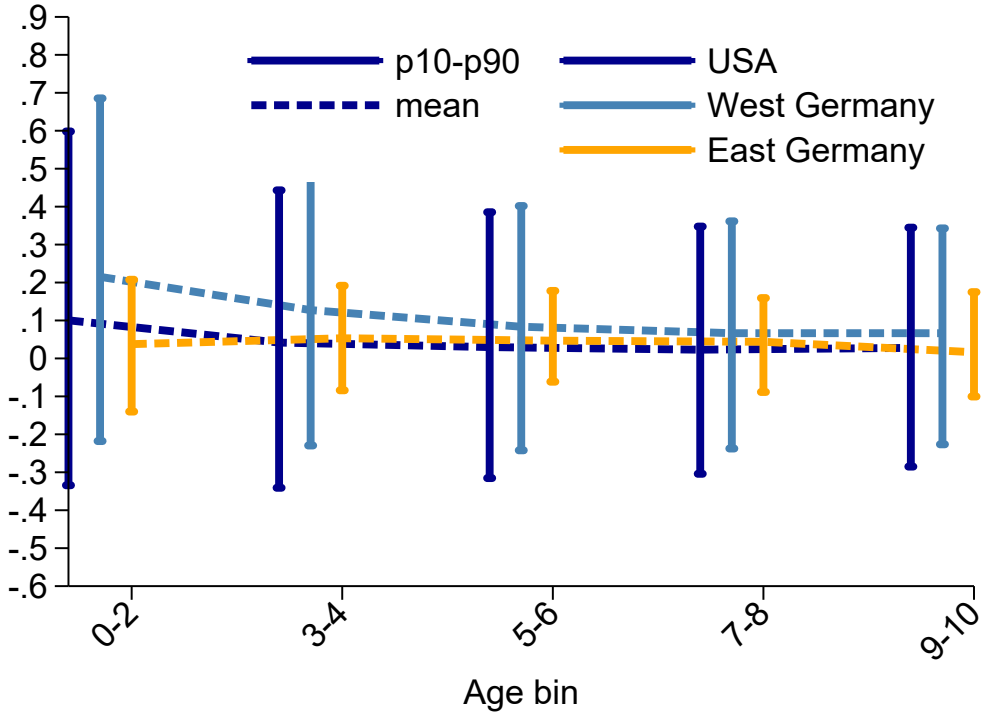
Notes: Computed assuming constant returns to scale and $\alpha = 0.33$. Growth series for planned economies based on physical output growth.
Data: West Germany: capital and industrial output from Heske (2013), East Germany: capital from Heske (2013), perpetual inventory method; industrial output growth from Sleifer (2011). USA: US Census Bureau, Russia: industrial output growth series from Ponomarenko (2001) based on official statistics on the physical output growth, capital growth series from Voskoboynikov (2021) computed with the perpetual inventory method.

Table 5: *Reallocation in Planned and Market Economies (80s)*

	Planned Economies		Market Economies	
	East Germany	Soviet Russia Manuf. Census	West Germany	USA
	1983-1988	1980 & 1988	1980-1988	1980-1988
Entry Rate	.3%	.05%	4.2%	8.94%
Exit Rate	.94%	.02%	4.23%	9.28%
Job Reallocation Rate (Survivors)	2.98%	2.62%	9.21%	17.47%
Employment Share of Young	1.45%	3.05%	3.32%	15.45%

Notes: All values are per year. JRR (Survivors) refers to job reallocation rates following (Davis and Haltiwanger, 1992; Davis et al., 1998) computed only for all firms in the manufacturing sector existing in t and $t+1$ for better comparability of the Russian data set with the other countries. Computed as $JRR_t = \frac{\sum_i |e_{j,t} - e_{j,t-1}|}{\sum_i 0.5(e_{j,t} + e_{j,t-1})}$, where $e_{j,t}$ is employment of firm j in time t. USA results as reported in Decker et al. (2020). Soviet Russia: due to data limitations young plants are represented by entrants between 1980 and 1989; entry and exit rates are computed using reweighting towards verified true and false entry and exit. See details in the text.
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East Germany), IAB EHP (West Germany), US Census Bureau BDS (USA).
Data: USSR manufacturing Census (Russia), GDR plan fulfillement survey (East-Germany), IAB EHP (West-Germany), US Census Bureau BDS (USA).

Figure 12: Revenue Growth Dispersion by Age Bin



Note: Employment growth by firm age (employment weighted). Employment growth is $g^e_{it} = \frac{e_{it}-e_{it-1}}{0.5(e_{it}+e_{it-1})}$, where e_{it} is employment of firm i in time t; Revenue growth by firm age (employment weighted): $g^r_{it} = \log(Y_{it}) - \log(Y_{it-1})$, where Y_{it} is the revenue of firm i in time t.
Data: USA (1996–2013): Haltiwanger et al. (2016), aggregated to the age bins, GDR (1985-1989): The Statistical Office of the GDR, West Germany: The Statistical Office of Germany

C Alternative Responsiveness & Persistence Specifications

While Decker et al. (2020) use levels for productivity in their baseline specification, they also provide an alternative specification in first differences:

$$g_{j,t} = \beta_0 + \beta_1(\omega_{j,t} - \omega_{j,t-1}) + \beta_2 e_{j,t} + X_j\Theta + \eta_{j,t} \tag{9}$$

This specification has the disadvantage that it requires observing the firm for three consecutive years, since future employment is predicted by past and current productivity. Thus, this specification is very challenging to execute even in representative stratified samples, where the weights are usually not calibrated to take into account such multi-year dependencies. As such, we do not use this specification in our main results, since especially in market economy Russia, but also in 90s Germany we have substantial issues getting reliable and representative coefficients.