Firm Dynamics and Growth in Planned vs. Market Economies

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Abstract

How important is creative destruction for economic growth? We address this question investigating economic productivity and firm dynamics in planned economies where the role of Schumpeterian forces is restricted by design. Using novel industrial-firm-level data from Soviet Russia and East Germany in the late 1970s and 1980s, we compare these economies against their market counterparts such as the US and West Germany. We document little response to productivity changes, with few firms entering or exiting in the former communist countries. Through counterfactual simulations, we conclude that enhancing responsiveness to productivity shocks and increasing the rates of entry and exit to the US levels could have boosted growth by about 2.3% 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

Economic growth in market economies is driven by the Schumpeterian forces of creative destruction: competition forces firms to increase productivity and secure profits; firms that increase their productivity grow and gain market share and otherwise shrink and exit the market. When less productive firms exit, resources can be reallocated to firms with higher productivity, fueling their growth. Naturally, distortions to the process of reallocation result in losses in aggregate productivity (Hsieh and Klenow, 2009; Bartelsman et al., 2013). Yet, while literature emphasizes the contribution of reallocation to growth, the question arises

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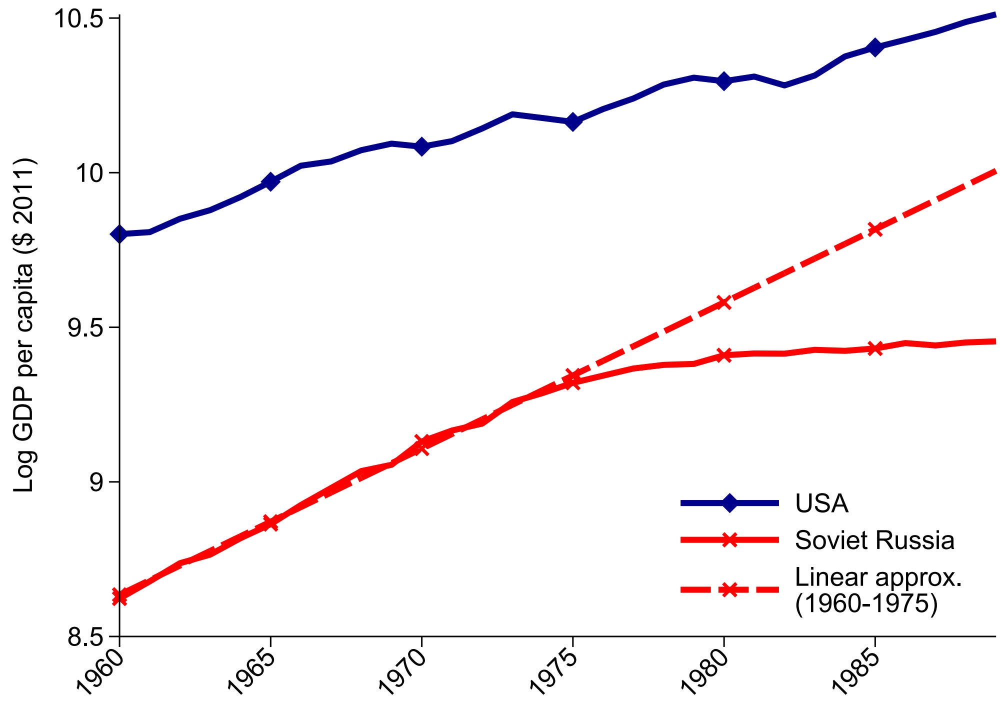
Figure 1: GDP per capita



Data: GDP per capita. Data: Maddison Project Database 2020 (**?**) .

how large is their impact? In order to answer this question we turn to the extreme case of planned economies.

Planned economic systems are the ideal test ground for our question: By design they relied almost exclusively on within-firm growth and shutting down the competition. At the same time, planned economies converged in GDP per capita to the level of market economies. E.g., because of the fast economic growth of the Soviet economy in the 1950s and 1960s, a belief that it was only a matter of time before the Soviet economy would overtake the US was a part of textbooks (E.g. Samuelson, 1961). Soon, however, economic growth gave way to stagnation and subsequent collapse of the communist block. This paper aims to revisit the factors of growth and slowdown with focus on factor reallocation.

We study firm behavior in selected planned economies – Soviet Russia and East Germany – and contrast it with selected market economies such as the US and West Germany in an effort to better understand the contribution of reallocation to aggregate productivity growth and to rigorously test the largely theoretical hypotheses about planned economies against our newly digitized data. We study firm entry and exit, its productivity contribution and the input responses of firms to productivity changes following Decker et al. (2020). We then simulate the economies of the GDR and Soviet Russia to understand the productivity implications of the recovered parameters. We find that XXXXXXXXX

Our paper builds on a large body of literature that uses firm level data to gauge the allocation of inputs to firms and its change over time. This literature was not available when the Soviet-type planned economies operated. Specifically, 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 explored in Akcigit and Ates (2023). To better understand the reallocation between firms, we adopt the shock-response framework from Decker et al. (2020) and push it even further by building several additional simulations of the long term implications of responsiveness to productivity shocks.

To make these contributions, we digitized the firm-level manufacturing data on the population of firms in Soviet Russia for 1980 manually extracted from the Russian archives and combined it with other available datasets on Soviet firms. To cover East Germany, we made the digital planning data of the GDR usable, which has recently been declassified by the German Federal Archive. To our knowledge, we are the first to thus provide firm level evidence for 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 the first to provide 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). There are 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. Together, these show the smaller role of reallocation in planned systems.

We follow 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). We show that planned economies were characterised 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.

Decker et al. (2020) estimate the productivity effect of slower responsiveness by assuming a higher responsiveness for existing firms and computing the new aggregate productivity implied by that. We extend their methodology, simulating productivity shocks, entry, exit and firm responses over longer time periods. This takes into account that additional gains from faster reallocation decline over time as the economy reaches a new equilibrium and overall allocation improves. We indeed find XXXXX

Especially during the Cold War, there was an active literature on the functioning of the planned system and its comparison with the West. Numerous papers discussed the industrial organization and incentives for growth in the planned system using economic theory (since very little micro data was available), which we review in section 2.1. With our micro data, we are able to back up this discussion with the stylized facts based on the analysis of the whole population of firms in industry in Soviet Russia and Eastern Germany.

Another long strand of literature is concerned with estimating the actual economic performance of the communist Bloc. Since prices were set by the planner, standard economic indicators become hard to interpret. Our firm level findings offer another answer to what is in this literature considered to be the puzzle of declining aggregate productivity (Ofer, 1987): Our model framework actually predicts declining aggregate productivity, given the parameters we estimate from the firm level data. 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.

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 details the Solow growth of planned economies up until 1975. Section 4 presents our theoretical framework and our findings about business dynamism in planned economies. Section 5 simulates counterfactual economies to understand the effect of our findings on aggregate growth. Section 6 concludes.

2 Background and Data

(Following Eillman, 2014)

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 provide elaborate ideas on how the production structure should be organized. These ideas were formulated only after the Russian Revolution of 1917, in "The ABC of Communism" (Bukharin and Preobrazhensky, 1920). The production process was viewed to be organized as one country-wide workshop with former individual firms turning into subdivisions within this country-wide workshop. They were supposed to follow a plant that covers both production targets and allocation of resources required to meet the targets.

2.1 The Institutions of the Planned Economy

In a planned economy, the central planner is directly subordinate to the political leadership, which defines a political goal for the economy. E.g. the "Politburo", the highest policy making authority of the communist party of the USSR or the Socialist Unity Party of (East) Germany, regularly discussed economic matters. The meetings of the Politbüro of the communist party of the GDR were dominated by economics in February (to discuss last year's plan and adjust this year's plan) and August (to discuss economic indicators of the first two quarters and make adjustments to the plan). This structure was copied from the USSR, where the "Politburo" served the same function. E.g. as Stalin's correspondence from the 1930s reveals, he guided the discussions on annual targets for the next year during summer months (Gregory and Harrison, 2005; Khlevniuk, 2008).

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 quarter 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 need 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 included a bargaining between the upper and lower agents, e.g. between the government and industrial ministries or ministries and their enterprises. The subordinates used information asymmetry on 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 (REF) 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 industries.

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 him to mitigate the information constraint.

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: State planning committee was supported with 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 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 new production processes and machines were developed, they should have been distributed to the production plants for implementation (Berliner, 1976).

Yet, enterprises had little incentives to adhere to the plan or to adopt new technologies: enterprises neither faced competitive pressure nor had they 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 (REF) 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 (REF)

To motivate firm managers, the government rewarded them for plan fulfillment proportionally to their 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.[1]

However, the incentive schemes based on bonuses could not generate the incentives for productivity growth similar to the incentives of profit maximizing firm owners in market economy. On the one hand, it was impossible to account for all the aspects of firms' acitivities in a single bounus scheme. On the other hand, incentives for innovation via bonuses created a dynamic problem or "ratched effect", effectively punishing the efforts to increase productivity. First, initially, only the output target was rewarded with bonuses. Output bonus disincentivised R&D (as it dragged resources from production); bonus for R&D activities resolved this, but the adoption was unappealing as due to temporary decrease in output production personnel was loosing their output bonus, and so on: every attempt to create an artificial bonus incentive only revealed yet another sphere with insufficient incen-

[1]Both in the USSR and the GDR, the governments tried to experiment with the best incentive schemes for managers. The so called Koysgin reforms in the USSR and the new economic system in the GDR in 1963 are probably the most famous. To stimulate productivity growth, the reforms were supposed to give firm managers greater freedom in their decision-making, together with higher bonuses for productivity increases. However, the planners only weakened their own planning prerogative for some marginal products and markets, but the use of important intermediate inputs, workers and capital was still planned centrally.

tives, while also created administrative burden of calculation and negotiation of bonuses (Berliner, 1976). What proved so difficult and ultimately fruitless in planned economies was naturally achieved through the price mechanisms and profit maximizing behavior of firms in market economies. Further to that, Dearden et al, (REF) emphasize the challenge of devising an incentives for technology adoption in hierarchical structures. They show that the USSR was relatively fast in with the first introduction of the modern technologies, but extremely slow with the diffusion of technologies to the rest of the economy. Dearden et al, (REF) argue with the help of a model that in a hierarchical structure the incentive costs of adoption increase at an increasing rate, which makes it extremely expensive to create the sufficient incentive system for managers to adopt new technologies.

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 and similar tricks. Accordingly, the literature conceptualizes plant managers as bonus maximizers (Berliner, 1957).

On the other hand, using bonuses to incentivize innovation incurs 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. The degree to which the planner ratchets up plan targets in response to productivity gains is thus a measure of the growth vs. static efficiency preferences of the planner.

Our new data offers us the first chance to actually test this effect empirically: Our GDR data 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

$$Y = \beta_P \frac{R_t}{R_t^P} \tag{1}$$

where $\frac{R_t}{R_t^P}$ is the fraction of revenue of year t and planned revenue for that same year at the start of year t. Y 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 1 reports the results from this estimation.

Table 1: *Ratchet Effect in the GDR*

	Plan change after a firm exceeds the plan		
	within year	start of next year	end of next year
	1985-1989	1985-1989	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 plans to initially increase by 60%, too. However, during the next year (probably as planning problems kept piling up), the planner would increase the targets by an additional 20%. Thus, a manger performing 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 last years of the GDR and any occurring innovation should probably be attributed to non-monetary motivations.

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[2], various regulations, ideological considerations and lobbying by networks of managers/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. In theory, these considerations could be derived from the plant production function. In practice, it was unobserved and difficult negotiations ensued. Labor reallocation was also subject to ideological constraints: Workers should 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.

Apart from such organizational obstacles, plants also had incentives to accumulate a reserve of workers (and other inputs): Managers had to anticipate that a negative shock might undermine plan fulfillment prospects and accordingly bonus payments. In such cases, having access to unused inputs might prove clutch in nevertheless fulfilling the plan. The ideological focus on employment exacerbated this problem: While workers could switch jobs, enterprises could not easily fill the vacant positions in the absence of unemployed workers (Berliner, 1976). Together, these factors worked against keeping plants 'lean' or actually declaring and using productivity reserves.

Our contribution: we contribute to the literature on the lack of job reallocation *holding innovation (prod. shocks) constant*

2.2 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.

2.2.1 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.[3] Both firm level cross sections cover the entirety of civilian manufacturing in the Russian Soviet

[2] Berliner (1976) emphasises that the economic decisions were often made without a sufficient knowledge and analysis due to scarcity of qualified economists: citing Kulikov et al. (1964)REF , "complex problems like optimal plant location are sometimes made like a blind man poking around on a map".

[3] 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.

Socialist Federation, the largest republic of the USSR.[4] The dataset contains more than 20 thousand firms and covers roughly 75% of manufacturing employment (mostly due to military 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). Comparing Brown et al. (2006) for 1989 with the 1989 cross-section, two dataset report the same variables for firms 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. However, we can observe that entry and exit rates are very low in our complete 1980 and 1989 data sets.

We detail our treatment of these data sets in Appendix **??**.

2.2.2 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. Most important for our purpose are the firm registry, the firm employment survey, the firm production survey and the firm plan accounting[5]. Together, these four surveys form our data set. 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 **??**.

2.2.3 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 4.1. 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.

[4] According to the official figures, Soviet Russia produced about 60% of the economic output of the USSR.
[5] Signatures DE2-MD 083, DE2-MD 028, DE2-MD 016 and DE2-MD 018, respectively.

2.2.4 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 this 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.

2.2.5 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 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 firm 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 firm 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).

Soviet managers 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.

State prices and socialist accounting practices create additional problems with the interpretation of statistics in planned economies. Importantly, firms faced the same prices set up by the central planner within industry. This makes comparison of monetary indicators possible at this or below levels.

The definition of a firm in a planned economy is itself non trivial. In Soviet-type planned economies, all manufacturing plants belonged to the state. Enterprises from the same industry were usually subordinated to the same industrial ministry. Due to managerial or logistic reasoning, similar or related plants were organized in a state trust or association but the majority were directly subordinated to industrial ministries. We follow our source to define the unit of observation for planned economies; de facto, it is usually plant or factory, i.e. an establishment.

3 Growth through capital accumulation - 1950-1975

3.1 Sources of Growth in the Solow Model (Theory)

Until the Kosigyn reforms, the economic strategy of the USSR and GDR was focused on Capital accumulation. Solow (1956) describes economic growth for such economies: In the medium run, capital accumulation increases growth, but in the long run it runs up against depreciation and capital growth stagnates: Consider an economy that produces according to the Cobb Douglas production function $Y = AL^{1-\alpha}K^{\alpha}$, where Y is output, L is labor supply and K is the capital stock. Growth in output per capita growth is

$$g_{\frac{Y}{L}} = g_A + \alpha g_{\frac{K}{L}} = g_A + \alpha s A(\frac{K}{L})^{\alpha} - \alpha g_L \frac{K}{L} - \alpha\delta\frac{K}{L} - \alpha g_A \frac{K}{L} \tag{2}$$

Growth in per capita output $g_{\frac{Y}{L}}$ is determined by technology growth g_A and growth in capital per capita, i.e. capital intensity. In the steady state, capital intensity is stable ($g_{\frac{K}{L}} = 0$), so per capita output growth is equal to technology growth. Outside the steady state, new investments which raise capital per worker increase the capital stock $\alpha s A(\frac{K}{L})^{\alpha}$, while population growth g_L, depreciation δ and technology growth g_A diminish capital per worker relative to the steady state.

Increasing the savings rate s leads to increased growth according to $\alpha s A(\frac{K}{L})^{\alpha}$. 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 to g_A again. A strategy of capital accumulation thus cannot lead to long term sustained high growth rates. Unfortunately, both the GDR and the USSR pursued such strategies in concordance with standard Marxist thinking.

3.2 Aggregate Growth Accounting for the Planned Economy

After the economic collapse of WWI, the 1917 Russian revolution and Civil war, the Soviet economy recovered to its pre-war level by the late mid-1920s (Harrison, 2013). To boost economic development beyond that, Stalin chose a Big push strategy of massive investments that assumed a termination of the NEP mixed economy, and an installation of a full-scaled command economy. Forced collectivization had to secure a transfer of resources from the traditional agricultural sector to the modern industrial sector. These massive capital investments into industry created a period of fast economic growth that allowed Soviet Russia to reach its pre-war economic growth trend by the late 1930s. Brutal fights at the Eastern front of WWII led to a enormous capital destruction in the Soviet Union and a return to rapid accumulation of capital during the first post-war years. In addition, the USSR planning committee gained de facto control over the resources of Eastern Europe and extracted substantial reparations in the form of capital goods. This also affected the newly founded East-German communist state, the GDR. While capital goods were deconstructed and shipped to Russia, people migrated into Western Germany. Thus, the capital to labor ratio probably stayed roughly constant in East Germany in the first decade after WW2, while it continued to rapidly expand in Russia (Heske, 2013). This policy of growth through capital accumulation can be seen clearly in the economic data:

The Soviet economy accumulated capital substantially faster than output was growing: from 1928 to 1985, capital was growing at an annualized rate of 7% and output at 4% (Ofer, 1987). Standard national accounting exercise reveals negative TFP growth during the two last decade before the collapse of the Soviet Union. The literature has been debating extensively to what extent this is 'true' negative TFP growth or an artifact driven by a poor data (hidden inflation in capital series) or a wrong choice of theoretical model (the rate of elasticity of substitution between capital and labor). Regardless of the resolution of this debate (i.e., whether Soviet TFP was actually shrinking or not), it is clear that the late Soviet economy continued to rely primarily on accumulation of capital and extensive model of development.

Table 2 shows the manufacturing growth performance of our four economies, decomposed into input and productivity driven growth between 1961 and 1990. To avoid biases from the arbitrary prices of planned economies, we use growth in physical quantities. 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 declining for the USSR (turning negative after 1975, see Table 3 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).

As discussed in section 2.1, the planners were aware of declining growth and tried to address it with the reform program of the 60s. However, the aggregate statistics do not show any positive effects.In the following chapters, we will use micro data to explore the functioning of the planned economy and understand the missing aggregate TFP growth.

4 Schumpeterian Dynamics

4.1 Schumpeterian Dynamics in Planned and Market economies

This section documents stylized facts on the Schumpeterian dynamics in planned and market economies. Four economies are pairwise compared: Planned economies are represented by East Germany and Soviet Russia and market economies by West Germany and the USA.

The facts describe the allocation and reallocation of labor across the production units. We use plants as defined in the market economies as the unit of observation, though there are some definitional difficulties: Market economies' definitions of plants are already not

Table 2: *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 **?** based on official statistics on the physical output growth, capital growth series from **?** computed with the perpetual inventory method.

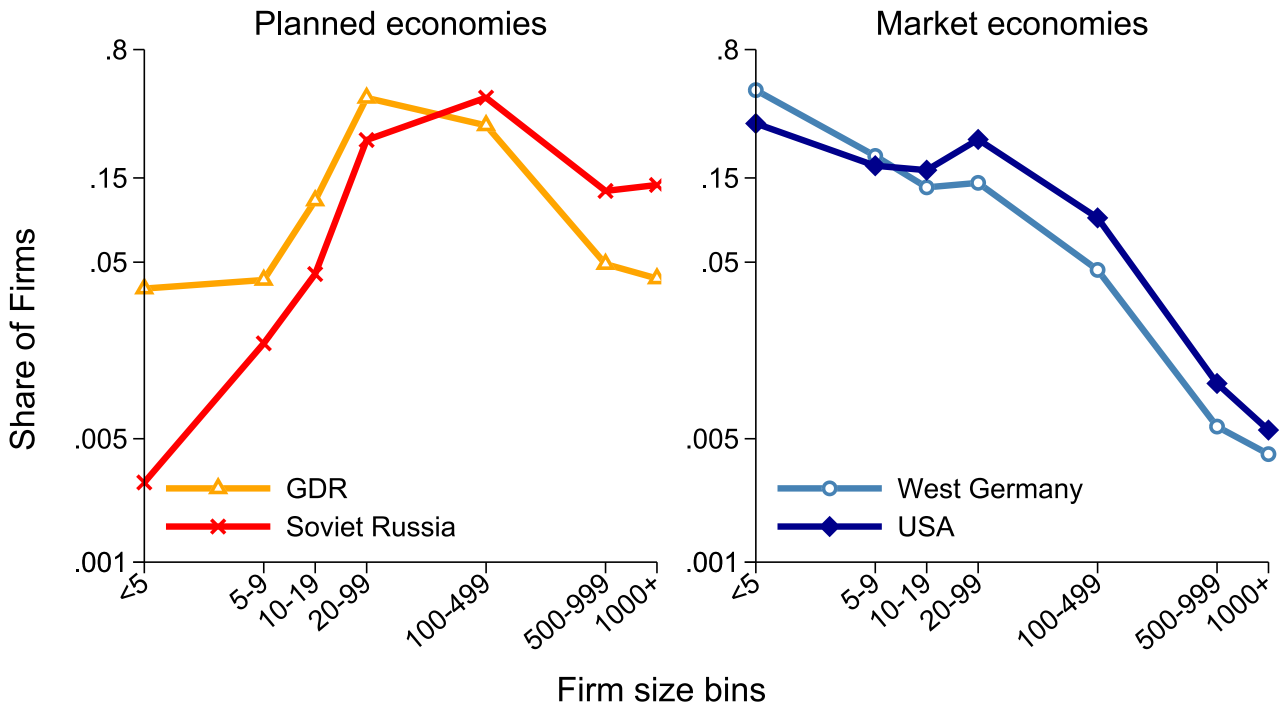
completely identical, while the difference between a firm and a plant is less clear in planned economies, where the state owns all means of production. We use the "plant registry number" (East Germany), the enterprises "with own balance sheet" (Russia), the "establishment" (US census) and the "plant ID" (IAB; West Germany) as roughly equivalent entities. Plants in the planned economies are jointly organized production processes and were headed by a plant manager responsible for plan fulfillment. They were usually, but not definitionally in one geographic location. In some ways, they are thus also akin to market economy firms. Smaller units of observation exist only for the GDR data, but these are at the level of individual street addresses and thus much finer grained than market economy plant data: E.g. the IAB subsumes all production of the same firm in the same sector and city into a plant. 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.

4.1.1 Size Distribution

Figure 2 shows the stark contrast in size distribution in planned and market economies. In market economies, small plants dominate, and the size distribution appears roughly linear in log-log space. in contrast, a hump-shaped size distribution in planned economies highlights the predominance of large plants, with a significantly smaller proportion of very small plants.

In planned economies, the number of firms in an industry creates a span of control problem: An industry ministry has to assign planned output and inputs to all firms, audit

Figure 2: Establishment size distribution



Note: The shares of firms in each size bin are averages across 1980, 1989.
Data: USA: BDS, West Germany: IAB EHP, GDR: The Statistical Office of the GDR, Soviet Russia: The Central Statistical Directorate of the USSR. For a detailed description of the data sources, see section 2.2.

them and coordinate the use of each firm's output (potentially by other firms). In order to do so, the central planner appoints a manager for the firm, observes outcomes and rewards accordingly, but does not manage the firm directly.

Soviet planning was especially concerned with the coordination problem that arises if one firm's output is another firm's input, which means the planner has to solve a high dimensional matrix. As a result, small companies are much rarer in planned economies than in market economies, while mid-sized and large firms are much more common. This is true within all sectors and across the entire economy.

On the contrary, the size distribution in market economies is shaped by the forces of creative destruction.

4.1.2 Employment Reallocation Speed

The speed of labor reallocation between firms is a natural measure of creative destruction. It consists of both the reallocation of labor between incumbents and the number of employees affected by plant entry and exit. Growth theory places a large emphasis on firms' entry and exit, as creative destruction is assumed to be a main driver of technological progress. This is borne out by empirical analysis, which has shown that newly entering firms are more reactive to productivity (Decker et al., 2020), make outsize contributions to job creation (Haltiwanger et al., 2013; Bravo-Biosca et al., 2013) and that slowing the reallocation towards newly founded firms impedes growth (Akcigit et al., 2021). We use the job reallocation rate as defined by Davis and Haltiwanger (1992) to capture the speed of reallocation between firms existing in t and $t+1$:

$$JRR_{c,t} = \frac{\sum_i |e_{j,t} - e_{j,t-1}|}{\sum_i 0.5(e_{j,t} + e_{j,t-1})} \tag{3}$$

where $e_{j,t}$ is the employment in firm j at time t. This measure is bounded between 2 (for entering firms) and -2 (for existing firms), but both of these extremes are impossible with our sample restriction. Figure 3 reports this indicator together with measures of entry and exit intensity.

Consequently, figure 3 reports the job reallocation rates, share of workers employed in entering firms, the entry and the exit rate. All the indicators show very small reallocation dynamics in planned economies. There are so few entering firms in planned economies that they have a small employment footprint, even though the average newly founded manufacturing firm in both Soviet Russia and East Germany is quite large (>100 employees).

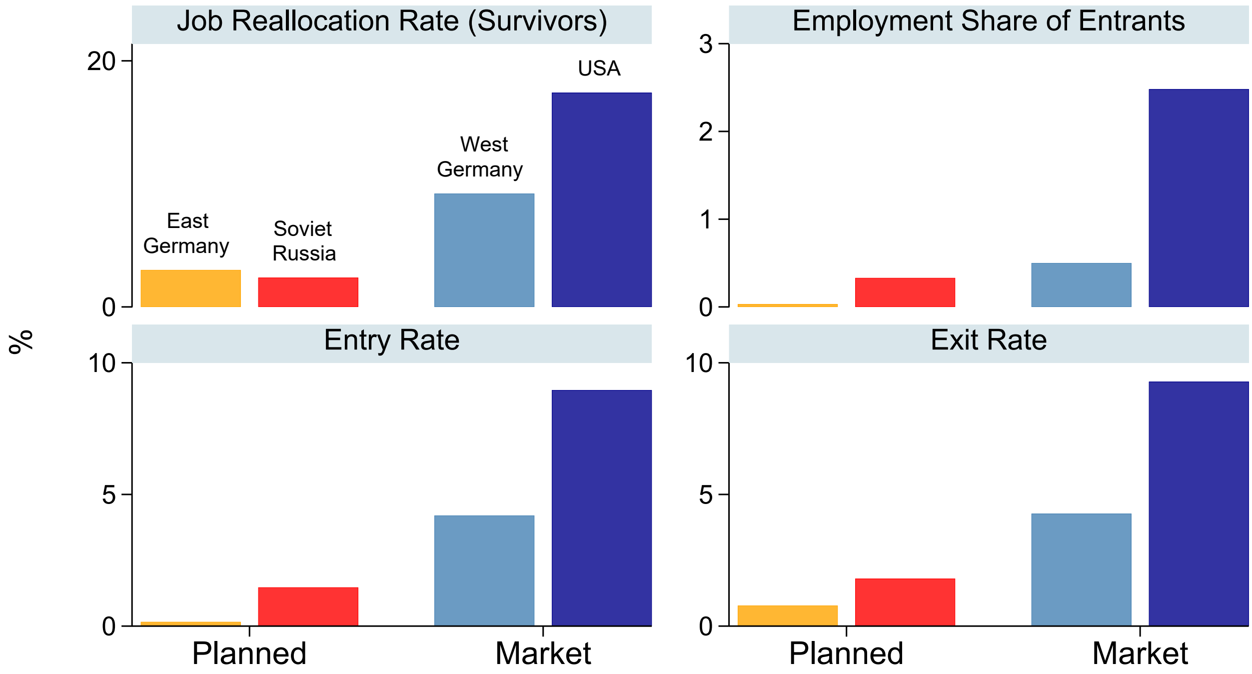
4.1.3 Growth over the Life Cycle

Entering firms have a special place in the theoretical and empirical analysis of market economies (Decker et al., 2020; Haltiwanger et al., 2013; Bravo-Biosca et al., 2013). They 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). How fast these new ideas and technologies have an impact on the economy depends on how fast young firms can grow their workforce.

In market economies, firms start small. They test their ideas on 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.

Hsieh and Klenow (2014) propose to operationalize this mechanism via the average size of surviving firms over their life cycle. The more an average firm grows with age, the stronger are the selection mechanisms in an economy, as they allow the reallocation of labor from less productive to more productive firms. Figure 4 compares the life cycle of an average establishment in planned and market economies. 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 and secure their position on the market. On the other hand, in planned economies the size of establishments over the life cycle follows a completely different pattern. Figure 4a follows Hsieh and Klenow (2014) and shows that in cross-section,

Figure 3: Reallocation in Planned and Market Economies

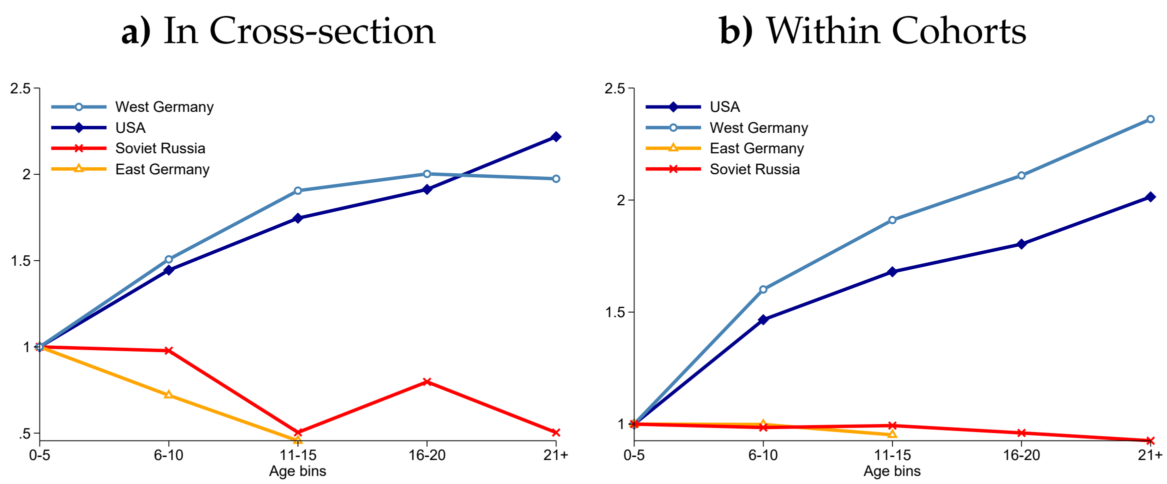


Note: Average values across several years: East Germany (yellow): 1983-1988, Soviet Russia (red): 1980 & 1989 (estimates reflect the upper bounds), West Germany (light blue): 1980-1988, USA (blue): 1980-1988. Manufacturing sector (results for non-manufacturing sector are qualitatively similar). USA results as reported in Decker et al. (2020). 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 j in time t only for survivors for comparability of the Russian data set with the other countries.
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East Germany), IAB EHP (West Germany), US Census Bureau BDS (USA).
The underlying numbers are presented in Table 4

older establishments in planned economies are smaller compared to younger ones. This pattern reflects the fact that the size of establishments is a planner's decision, and younger establishments were entering of larger size (due to economic reforms aimed at consolidation of industrial management). This peculiarity of planned economies is taken into account in Figure 4b, which shows the life cycle of plants within cohorts. Once the cohort differences are accounted for, the graph shows that the average establishment size in planned economies does not change over the life cycle. Establishments' entry and size is predetermined by the planner; not only is the entry rate very low, but the entrants also do not create competitive pressure on incumbents and do not aim for growth in size and in market share.

This difference in experimentation and selection dynamics between planned and market economies is illustrated in Figures 5, which show how the distribution of revenue and employment changes with firms' age. For planned economies, the dispersion of growth rates is much smaller per se, while it also does not change over the life cycle: Young firms do not

Figure 4: Establishment Life Cycle: Average Size by Age Bin



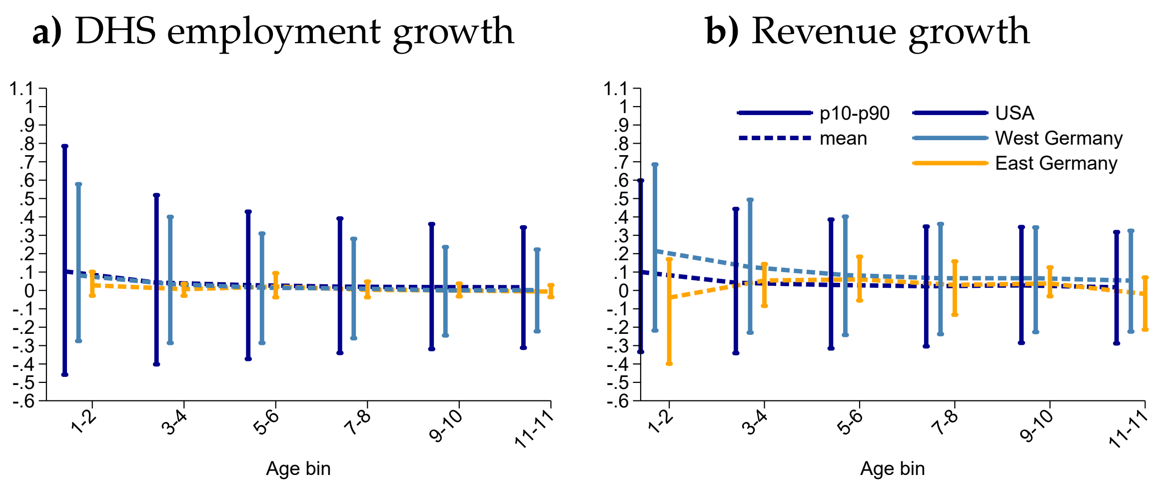
Note: The graph reports the average size by age bin, normalized to the average size of the youngest bin. For Figure 4a the size of the age bins is computed with cros-sections: 1980 for Soviet Russia, 1986 for the East Germany, 2000 for the USA and West Germany. For Figure 4b the average plant size by age bin, normalized to the average size of the youngest bin, is 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.
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East-Germany), IAB EHP (West-Germany), US Census Bureau BDS (USA)

experiment with new ideas and technologies. This is because a planner is making a decision regarding firms' size, technology and output targets, and allocates resources required to reach these targets. Hence, firms do not have sufficient incentives to experiment and grow beyond the required targets. The revenue growth in planned economies shows higher dispersion comparing to employment growth: Planned targets demanded yearly growth in output, but the inefficiencies of the planned economic system could also lead to negative revenue growth rates (e.g., a firm could fail to meet an output target if it was not supplied with sufficient intermediaries).

In market economies, not only is the dispersion much higher compared to planned economies, but it is also higher for young establishments and decreases with establishments' age. As young establishments enter, they bring new ideas and test them on the market; those that are successful experience high growth, while those with non-competitive ideas are shrinking. With age, the dispersion decreases as establishments secure their market share and reach their optimal size.

At the same time, the dispersion 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

Figure 5: Growth Dispersion by Age Bin



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

old firms on the market is constantly challenged by new ideas, technologies and business models of younger firms. Elder firms can either keep up or shrink and exit the market.

As a result, the size composition of a cohort is changing with age, as shown in Figure 6. In market economies, most of the entering establishments are small, and hence the share of small establishments is the largest in the youngest bin. With age, establishments grow and the share of small ones is decreasing. Still, even for the oldest age bin, there is a sizable fraction of small firms. This is because even though elder firms managed to withstand the competition for over a long period, they are still facing the threat from newly entering firms and some of them will not be competitive and shrink.

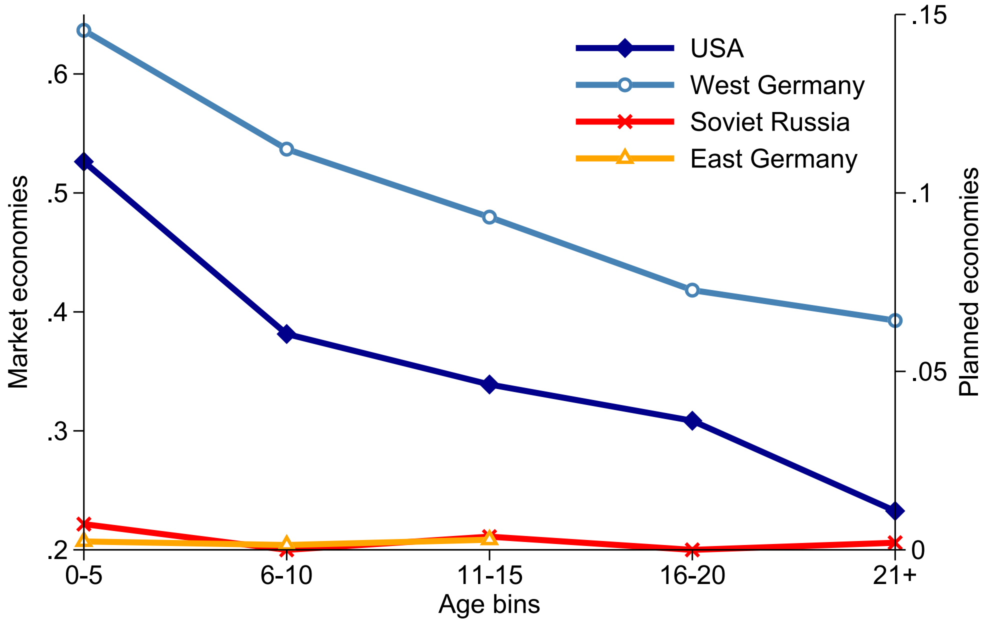
In planned economies the share of small establishments is negligible and does not change with age. The majority of firms were entering large and in the absence of competition they were not shrinkng.

4.1.4 Productivity shocks

Firms' efforts and successes in development and adoption of new technologies or business models are reflected in year-to-year productivity changes. Implementation of new technology is risky and can result in either growth or decline in productivity. The range, or dispersion, of these shocks reflects the level of experimentation in the economy.

Figure 7 shows the distribution of labor productivity shocks for four economies and reports means and standard deviations of the distributions. While the size of an average productivity shock is rather similar in planned and market economies, the dispersion is

Figure 6: Share of Small Firms by Age Bin



Note: Small pants are plants with less than 5 employees. The shares are computed for the following crossections: 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 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), US Census Bureau BDS (USA), reported in Akcigit et al. (2021) replication package.

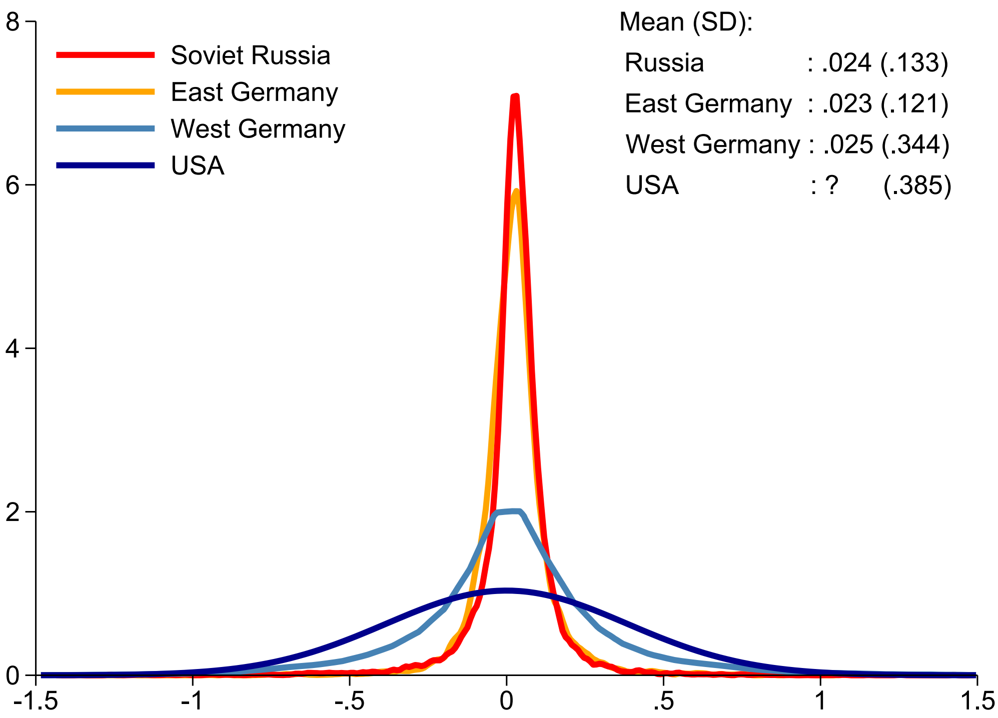
substantially smaller in planned economies. For the latter, the incentive structure of firms was intended to motivate firms for productivity growth via constant increase in output targets. However, there was no incentive to deviate from target, as deviation in either direction would be punished - either via loss of bonuses or via higher targets for next period ("ratchet effect", discussed in Section REF. As a result, the productivity was bunching around the targeted productivity growth.

In market economies, where the up-or-out dynamics creates the incentives for productivity growth, the productivity shocks are much more dispersed: firms have higher incentives to experiment, and are also more likely to be challenged by experiments of other firms. This results in much larger dispersion of the shocks.

4.1.5 Reallocation in Response to Productivity

Theoretically, firms change their labor demand and thus cause reallocation when they experience a productivity shock. Thus, reallocation between firms is driven by the size of such shocks and the responsiveness of firms to them. Both the market and the planner should

Figure 7: Productivity shocks in planned and market economies



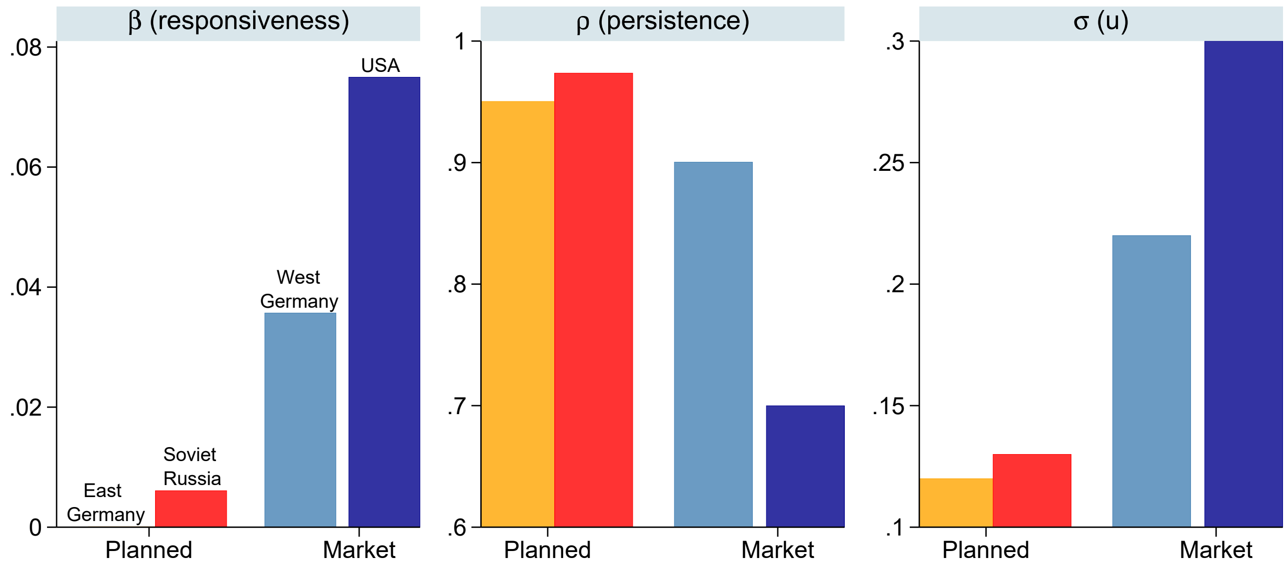
Note: Firm level productivity shocks measured as the first difference in log real revenue productivity. US values are imputed from (Decker et al., 2020), see Appendix B for details. Years: GDR: 1985-1989, Soviet Russia: 1985-1987, West Germany: 2002-2010, USA: 1997-2013.
Data: GDR: GDR plan fulfillement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

reallocate 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 aggregate productivity growth. Decker et al. (2020) provide both an estimate of the importance of this channel in the US market economy and an estimation framework to use on other countries. We apply their framework to our economies. Specifically, we estimate their equations to (1) and (2) for productivity persistence and responsiveness, respectively. Productivity persistence is estimated as an AR1 process

$$a_{j,t+1} = \rho a_{j,t} + \Theta_{s,t} + \varepsilon_{j,t} \tag{4}$$

where ρ measures the degree to which this year's productivity predicts next year's expected productivity. 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 the size of the random shocks $\varepsilon_{j,t}$, which randomly

Figure 8: Productivity Shocks and Firms' Responsiveness



Note: Unit of observation: harmonized firm identifiers. USA results as reported in (Decker et al., 2020); the preferred estimate for the USA, reported on the graph, is based on labor productivity (as the estimates for all other countries) and covers 1997-2013, the second estimate, reported in the table, is based on the TFPS and covers 1980s, both estimates paint similar picture of persistence and responsiveness in the USA. .
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 2.2 and in even more detail in Appendix A. The underlying numbers are presented in the table 5

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.

$$g(l)_{j,t+1} = \beta a_{j,t} + \gamma l_{j,t} + \Theta_{s,t} + u_{j,t} \tag{5}$$

where $g(l)_{j,t} = \frac{l_{t+1} - l_t}{0.5*(l_{t+1}+l_t)}$ (often called DHS growth), $a_{j,t}$ is productivity in period t and $l_{j,t}$ is employment at time t. Despite beeing 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 unit j had equilibrium employment at time t, taking into account its productivity at time t. β measures the speed with which it responds to the new productivity draw $a_{j,t+1}$. We follow the empirical specification "RLP" of Decker et al. (2020) (regarding productivity measurement, control variables, timing of variable measurements etc.) as close as possible and thus estimate the responsiveness of planned and market economies in every year. Figure 8 reports the results of all these estimates per country.

Planned economies are outliers both in productivity persistence (which is very high) and in 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 in both.

Lower responsiveness is a sizeable drag on planned economies. Since we observe the productivity evolution, we can compute how much higher aggregate productivity would have been, had the social planner reshuffled employment as fast as the US or even West German economy. We find that one year of such faster responses would have increased aggregate productivity by 1.5%. These gains are substantial, but still less than similar comparisons done by Decker et al. (2020) for the US over time. The reason for this is that productivity dispersion is lower in planned economies in general, which limits gains from reallocation. To estimate the long term gains from productivity, we simulate the East-German and Russian economy with different responsiveness, entry and exit parameters over longer time periods in section 5.

5 Counterfactual Simulations

5.1 Simulation Setup

First, we estimate time invariant persistence and responsiveness parameters that represent the planned economy during its productivity slowdown. Since the (endogenous) firm distributions in planned and market economies are so different, we estimate size and age class dependent but time invariant versions of equation (5) and (4) for a more robust comparison. Specifically, our time invariant productivity law of motion / persistence is estimated from

$$a_{j,t+1} = \rho * a_{j,t} \times \Gamma_{z,t} \times D_{age\geq 5} + \Gamma_{z,t} + \zeta_{j,t} \tag{6}$$

Productivity $a_{j,t}$ evolves according to an AR(1) process characterized by a different ρ in each group defined by size class and age. The effect of ρ and the standard deviation of shocks $\zeta_{j,t}$ determines the equilibrium productivity spread within each group and defines different expected trajectories of future productivity: Since productivity $a_{j,t}$ is defined in log deviations from the sector mean, a high persistence means that firms are expected to retain their relative productivity position, while a low productivity persistence means that firms trend towards the sector mean faster. The estimate is agnostic as to the exact mechanisms behind the regression towards the mean estimated by ρ within and across groups. 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. Alone, $0 < \rho < 1$ would imply that the firm productivity distribution flattens over time as all firms converge towards average productivity 0. However, the entry of new firms with disperse productivity and the random shocks $\zeta_{j,t}$ work against this tendency. The interplay between these three forces determines aggregate productivity dispersion and thus also the scope for reallocation.

We estimate firms' employment and exit responses using a similar variation of equation 5:

$$Y_{j,t+1} = \beta * a_{j,t} \times \Gamma_{z,t} \times D_{age \geq 5} + \gamma * l_{j,t-1} \times \Gamma_{z,t} \times D_{age \geq 5} + \Gamma_{z,t} + u_{j,t} \tag{7}$$

where $Y_{j,t+1}$ is either the DHS emplyoment growth $g(l)_{j,t+1}$ or the exit probability $D^{exit}_{j,t+1}$ of firm j. This also allows responsiveness to vary between age and size groups. Ex ante, we would expect young market economy firms to be more responsive to productivity, especially with exit. Given our parameterization, we can interpret β roughly as the percentage change in employment (either through the exit probability of the firm or continuous change of surviving firms).[6]

Unfortunately, we are unable to perform such a detailed regression in 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).

Figure 9 reports the results from estimating equation (6) and (7): There are striking differences between planned and market economy firms even for firms within the same group, especially for young firms: Young 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.

This highlights that the firm composition is another important part of overall responsiveness: Mature firms in the largest size category are only marginally more responsive than their East German counterparts, but they are much fewer.

This is a bit different in the exit margin. Of course, exit is an extremely rare event in planned economies, so its responsiveness to productivity could not be estimated in many

[6] 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.

categories due to there being no exits. However, exit responsiveness in planned economies is economically 0 wherever observed. This is in stark contrast to market economies. Though West Germany is famous for its strict worker protection and political resistance to drastic structural change, exit responsiveness is an economically meaningful contributor to overall responsiveness. US exit responsiveness is substantially higher and highlights the strength of the 'experimentation and shakeout'-process (Cunningham et al., 2021) in the US.

To gauge the effects of the substantial differences in responsiveness and shocks documented in section 4, we simulate counterfactual scenarios for the planned economies in our data set with alternative responsiveness. To simulate the planned economy in Russia and East Germany, we use equations (4) and (5), which together are enough to describe firm behavior: Equation (4) gives a law of motion for each firm's productivity by estimating productivity persistence. We use it to forecast productivity for all firms in the economy over time. Equation (5) describes how a firm would adjust its labor demand in response to productivity shocks. We combine both to simulate economies to understand the effect of the coefficients estimated in 4 and consider three different margins: a higher responsiveness of incumbents to productivity shocks, entry of new firms and exit as a response to productivity.

To simulate the economy for one year, we first predict firm productivity according to equation (6), drawing a productivity shock from the appropriate sector size class bin. We then predict employment using last year's productivity and employment, again drawing shocks from the appropriate bin.

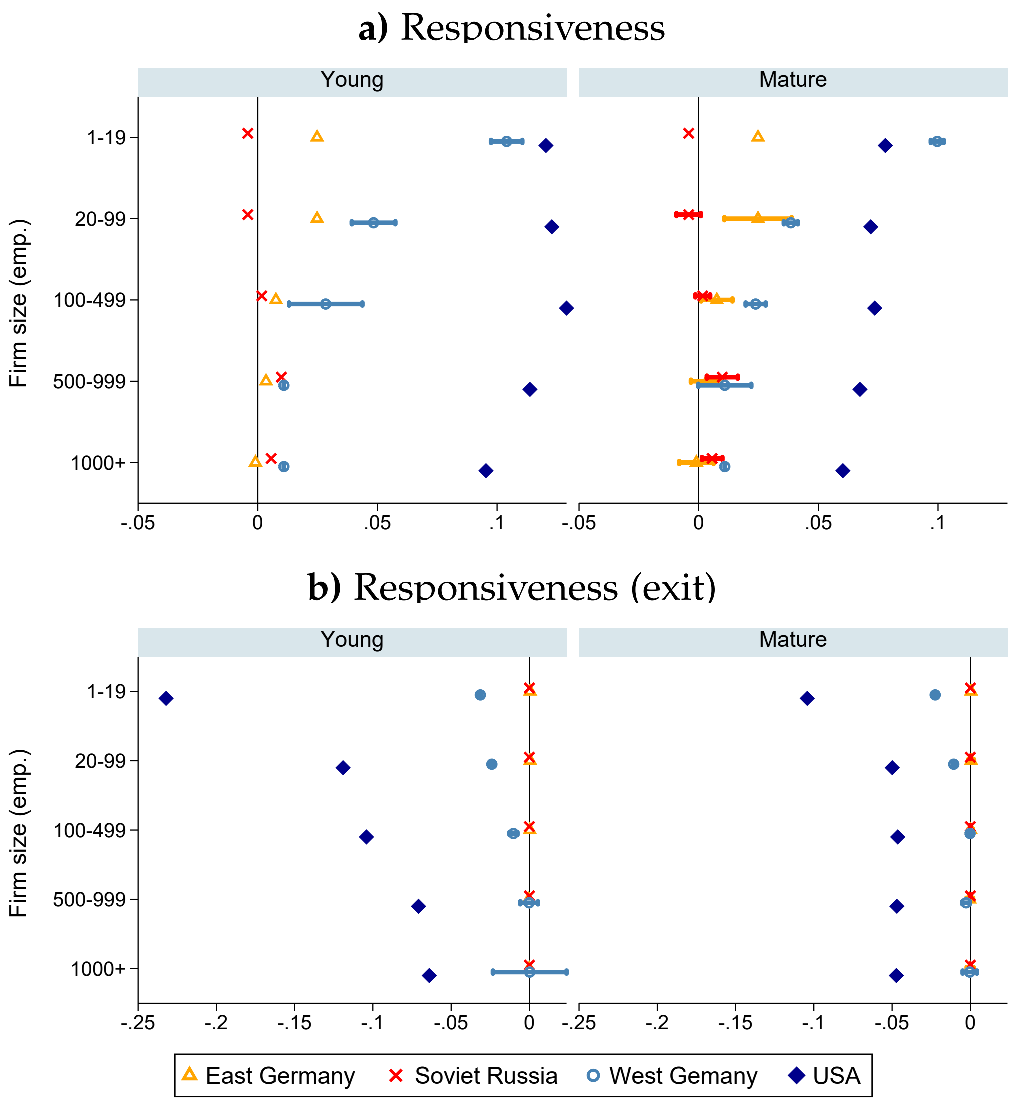
However, firms' labor demand decisions also have general equilibrium implications. This can be easily seen from firms' equilibrium labor inputs in our model (equation **??**). Thus, our simulation procedure yields a sum of firms' labor demand that is different than aggregate supply, depending on which firms draw which productivity shocks. However, in our framework, the economy wide equilibrium wage is part of the estimated fixed effects. To bring labor demand and supply into line, we therefore adjust the constant of equation (7) until aggregate labor demand and supply equate, the equivalent of the wage determination in our theoretical framework. Appendix E reports results with various alternative specifications.

5.2 The Macroeconomic Effect of Responsiveness

5.2.1 Counterfactual A: Responsiveness of incumbents

Increasing the responsiveness of existing firms is the least invasive change of 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 to the market economy counterpart. However, firm exit and entry remain as they were. This leads to higher aggregate productivity by reallocation of labor to the better firms. The size of the change depends on the group of firms: As discussed,

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
Exit rate (age =0)	1.6%†	0.8%†	12%	25%
Exit rate (1$\leq$ age$\leq$ 5)	1.6%†	0.8%†	8%	10%
Exit rate (5$\leq$ age)	1.6%	0.8%	4%	8%
$corr(u_{j,t};\zeta_{f,t})$	-0.12	-0.58	-0.32	-

Notes: Statistics marked with † cannot be estimated and are imputed from neighbouring groups. US results from ()

mature and large firms are less responsive in market economies, too. Since the firm distribution remains that of a planned economy with its over-reliance on such firms, this change alone plays into the weaknesses of market economies, not their strengths. Nevertheless, the productivity gains are substantial.

5.2.2 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 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 1980s US and 0.7% in West Germany (in the 2000s, unfortunately firm entry data for Germany does only exist from 2002 onwards). Average firm size at entry varies between market economies, (10 in 1980s and 1990s US according to BDS, 3.4 in Austria, 2.6 in Germany, 9 in Norway, 7.1 in Sweden and 4.7 in the UK 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.

When entering, firms do not have markedly higher productivity than the average firm in their sector (Pancost and Yeh, 2022). Thus, without additional reallocation or exit, the contribution of entry to productivity is low. However, after entry, firms react faster to productivity (both with employment changes and exit) 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. 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).

5.2.3 Counterfactual C: Exit of Incumbents

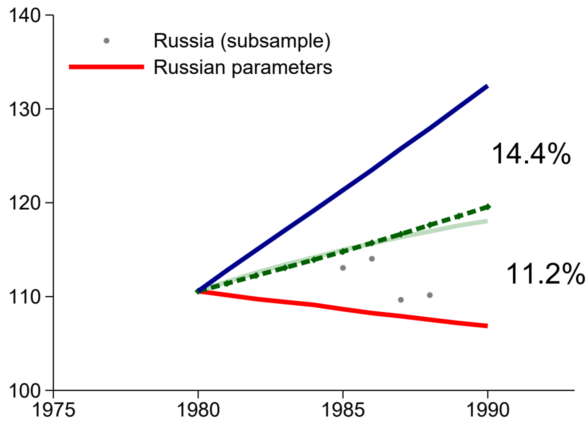
Schumpeterian destruction of incumbents is a central driver of market economies' efficiency gains. It is also a radical departure from the planned system, where plants virtually never exited due to inefficiency and the state guaranteed employment to every worker. Thus, it is our last counterfactual scenario. Switching the responsiveness of exit and the exit rate of firms to market economy levels contributes substantially to reallocation. The large and mature firms that are typical for planned economies are not very likely to exit in market economies, either. Nevertheless, since much more very unproductive and still large firms exist 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.

Section 2 has presented the view that planned economies failed in their transition from a capital accumulation growth strategy to one based on productivity improvements in the 70s. To gauge the effect of this failure, we simulate the planned economies and their counterfactuals from our earliest data point (1975 for East Germany and 1980 for Russia) and see how far an economy with stronger dynamism diverges from the simulation with original parameters.

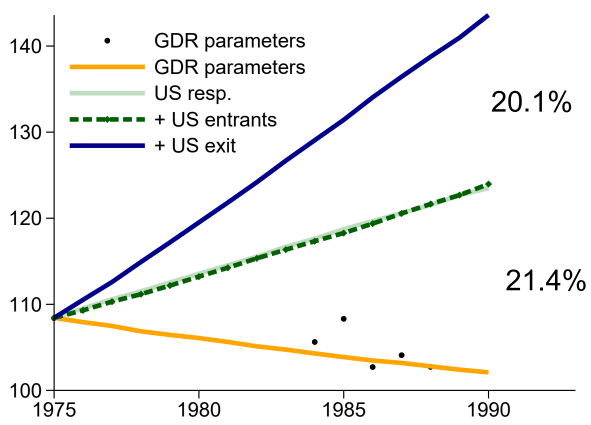
In case of East Germany, this is problematic insofar as we do not observe productivity in 1975, only employment. To deal with this, we use the first actually observed productivity for each firm (usually from 1984). Given the extremely high persistence of productivity in East Germany and the lack of firm entry and exit, this allows for a reasonable approximation of the 1975 East German manufacturing sector. Appendix E reports alternatives to approximate the 1975 East German economy and their effect on the results. Remarkably, due to the lacking dynamism of the planned economies, different approximation strategies lead to very similar results.

Figure 10 reports simulation results starting from the earliest available micro data for each country. Panel 10a reports the results for our counterfactuals starting with the 1980 Russian manufacturing sector. We report the counterfactual economies together with the allocative efficiency 1985-1989 as observed in the subsample of the manufacturing sector from Brown et al. (2006). While allocative efficiency in that sample declines as predicted by the simulation, the level is different. Increasing the responsiveness of existing surviving firms to US levels yields a substantial aggregate productivity increase: In the 10 years after 1980, the higher responsiveness economy outperformed the baseline by 11.2%. 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: It shifts employment substantially 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.

Figure 10: *Simulation Results - Planned Economies with Market Economy Responsiveness*



a) Russia 1980



b) East Germany 1975

Notes: Simulated effect of higher responsiveness, entry of market economy firms and exit according to market economy parameters as described in section 5.2. With annoted accumulated productivity difference between the scenarios in 1990 (demise of planned economy system).
Separate simulations starting at the earliest available micro data for Russia (1980) and the GDR (1975)
Sources: For a detailed description of the data sources, see section 2.2.

Panel **??** reports the results for our counterfactuals starting with the 1975 firm portfolio. The picture is very similar: The big productivity gains come from increasing the responsiveness of incumbent firms and their exit rate, which causes massive labor reallocation towards the productive firms, incumbents and newly entering firms alike. Just like in Russia, with the parameters estimated in the data, East German allocative efficiency declines over time. This effect occurs because firms receive smaller (than in market economies), but still substantial productivity shocks (standard deviation of shocks is 12% of sector mean). Thus, allocative efficiency becomes worse as the social planner does not respond to these shocks. 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 market economy portfolio of firms, but let allocative efficiency and productivity dispersion decline.

Both in Russia and in the GDR, switching towards US responsiveness parameters yields a productivity increase of 2.3% per year, accounting for the entire productivity growth gap between these economies.

5.3 Robustness: Different Initial Conditions

To better understand the effect of initial conditions on our estimates, we start our simulations at four different starting points, two fictional, two real. Specifically, we aim to understand the impact of the initial allocation of workers to firms and the initial productivity dispersion.

The first starting point is a fictional economy where all firms have the same productivity $a_{j,t} = 0$ and the same size (380 workers, the average size of our East German firm sample in 1975). The second starting point is a fictional economy where all firms have the productivity values from the East German 1975 distribution but still identical size. The third starting point is our approximation of the East German manufacturing sector in 1975. It is only approximate since we have to assign firms their productivity values from 1985 because production data is not available before. However, the extreme persistence of productivity makes this a defensible approximation. The labor values are those actually reported in 1975. The forth and last starting point is the Russian manufacturing sector as observed in our newly digitized manufacturing census in 1980.

When simulating the economy from these initial conditions, aggregate productivity levels will of course be different. However, we are mainly interested in how much the effect of higher responsiveness in our counterfactuals depends on initial conditions.

6 Conclusions

Our paper studies the effect of business dynamism on growth using the planned economies of the communist system as case studies: Their reallocation, entry and exit 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 East-Germany from 1975 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. We find that the most significant contribution is the interplay between entry and immediate culling of unproductive entrants that happens in dynamic market economies. This creates growth both by reallocating labor to the productive surviving entrants and by exerting competitive pressure on incumbents. Even when starting with a planned economy, characterized by large conglomerates unlikely to exit, this entry component creates more growth than raising the responsiveness of existing firms to productivity: We estimate that the GDR economy lost 12% of productivity growth between 1975 and 1990 due to not having an economically relevant firm entry rate and exit rate and "only" 7% due to the very low responsiveness of existing firms to productivity. Together, these two components explain a sizable part of the failed convergence between planned and market economies.

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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.

A.0.2 Russia (RF)

First, we use the aforementioned Brown et al. (2006) to track a significant sample of ex-USSR firms during the transition to the market economy. Second, Slinko et al. (2003) built a data set on Russian manufacturing firms they used to study regulatory capture in the 1990ies. This data covers the largest part of manufacturing in the Russian Federation. Later, the Ruslana, Orbis and Spark data sets offered by Bureau van Dijk and Interfax are constructed based on obligatory registry notifications. Ruslana and Orbis start in 2004, but coverage improves steadily throughout the 2000nds and reaches 80% of the Russian economy only in 2010. Spark is available from 2016 onwards. Figure 11 reports Russian manufacturing employment and the employment covered in our various data sources. Both Oribis and Ruslana offer unique challenges when multiple consequtive observations of the same firm are required. Namely, growing (in any dimension) firms seem to have a higher probability to have nonmissing variables than shrinking firms. We conjecture that at least some variables are gathered retroactively for firms that would eventually reach a certain threshold. However, we have been unable to confirm this policy with BvD. Unfortunately, this makes some of our analysis very challenging. Thus, we do not use either Ruslana or Orbis as our preferred sample when dealing with dynamic firm indicators. On the other hand, coverage in all three data sets is high enough to make statements about the large incumbents covered nearly completely and offer reasonable approximations about the aggregate economy when consecutive observation are not necessary.

A.0.3 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[7]. 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

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

Figure 11: Russian Industrial Employment

2_background/covered_employment_russia_manufacturing.pdf

Notes: Russian Industrial Employment (including secret/military employment) in aggregate statistics and the various data sources used in our analysis. Coverage is as high as 80%, but is significantly lower for some years, especially in the late 1990ies.

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.

During the transition to a market economy, 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. Due 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 Facts

B.1 Capital Accumulation

B.2 Industrial Output Growth Decomposition by Periods

B.3 Reallocation in Planned and Market Economies

B.4 Productivity Shocks and Firms' Responses

C Model Derivations

C.1 Labor Demand in Decentralized economy

Firms maximises profit: $\pi_{j,t} = a_{jt}^{1-\kappa} l_{j,t}^{\alpha} - w_t l_{j,t}^{\phi+1}$

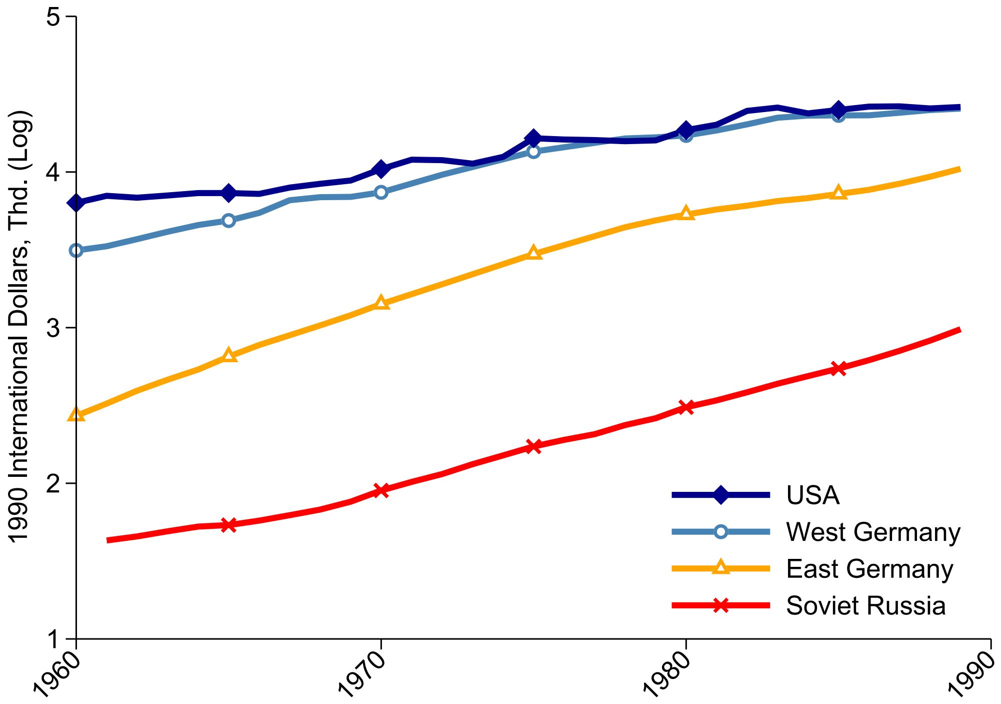
Set the FOC with respect to l_{jt} to 0 to derive labor demand:

$$\frac{\partial \pi_{j,t}}{\partial l_{j,t}} = \alpha a_{jt}^{1-\kappa} l_{jt}^{\alpha-1} - (\phi+1) w_{jt} l_{jt}^{\phi} = 0 \tag{8}$$

$$l_{j,t} = \left(\frac{\alpha a_{j,t}^{1-\kappa}}{w_t(1+\phi)} \right)^{\frac{1}{\phi+1-\alpha}} \tag{9}$$

Formulate labor market equilibrium with labor supply being a function of ratio of labor

Figure 12: Industrial Capital per Worker



Data: *Note:* Germany and Soviet Russia: manufacturing, mining and utilities. USA: only manufacturing. The data from the respective sources is converted to 1990 International Dollars with the conversion rates constructed as the ratio of the GDP of countries in the currency of the data sources and the GDP in 1990 International dollars provided in Maddison Project Database 2010
Data: East and West Germany: Heske (2013) , Soviet Russia: **?** and the **?** , USA: data: NBER manufacturing industry database, deflator: FRED.
.

demand in high and low-productivity firms:

$$S = 0.5M(l_h + l_l) = l_l 0.5M\left(1 + \frac{l_h}{l_l}\right) \tag{10}$$

Hence, l_l is derived as

$$l_l = 2\frac{S}{M} \Big/ \left(1 + \frac{l_h}{l_l}\right) \tag{11}$$

Ratio of labor demand in high- and low-prod. firms $\frac{l_h}{l_l}$ is

$$\frac{l_h}{l_l} = \left(\frac{\alpha a_h^{1-\kappa}}{w(1+\phi)}\right)^{\frac{1}{\phi+1-\alpha}} \Big/ \left(\frac{\alpha a_l^{1-\kappa}}{w(1+\phi)}\right)^{\frac{1}{\phi+1-\alpha}} = \left(\frac{a_h^{1-\kappa}}{a_l^{1-\kappa}}\right)^{\frac{1}{\phi+1-\alpha}} \tag{12}$$

Plugging in the productivity ratio into eq. **??** results in expression of labor demand of low-producitivity firm:

$$l_l = \frac{2S}{M}\frac{a_l^{\frac{1-\kappa}{\phi+1-\alpha}}}{a_l^{\frac{1-\kappa}{\phi+1-\alpha}} + a_h^{\frac{1-\kappa}{\phi+1-\alpha}}} \tag{13}$$

Table 3: *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 **?** based on official statistics on the physical output growth, capital growth series from **?** computed with the perpetual inventory method.

C.2 Aggregate Labor Productivity in Decentralized Economy

$$\begin{aligned}
\Omega^d =& \frac{Q^d}{S} = \frac{0.5M}{S}(a_h l_h^\alpha + a_l l_l^\alpha) = \\
&= \frac{0.5M}{S}\left[a_h \underbrace{\frac{a_h^{\frac{(1-\kappa)\alpha}{\phi+1-\alpha}}}{\left(a_h^{\frac{1-\kappa}{\phi+1-\alpha}} + a_l^{\frac{1-\kappa}{\phi+1-\alpha}}\right)^\alpha}\left(\frac{2S}{M}\right)^\alpha}_{l_h^\alpha} + a_l \underbrace{\frac{a_l^{\frac{(1-\kappa)\alpha}{\phi+1-\alpha}}}{\left(a_h^{\frac{1-\kappa}{\phi+1-\alpha}} + a_l^{\frac{1-\kappa}{\phi+1-\alpha}}\right)^\alpha}\left(\frac{2S}{M}\right)^\alpha}_{l_l^\alpha} \right] = \\
&= \left(\frac{2S}{M}\right)^\alpha \frac{0.5M}{S} \frac{a_h^{\frac{\alpha-\kappa\alpha+\phi+1-\alpha}{\phi+1-\alpha}} + a_l^{\frac{\alpha-\kappa\alpha+\phi+1-\alpha}{\phi+1-\alpha}}}{\left(a_h^{\frac{1-\kappa}{\phi+1-\alpha}} + a_l^{\frac{1-\kappa}{\phi+1-\alpha}}\right)^\alpha} = \\
&= \left(\frac{S}{M}\right)^{\alpha-1} a_0^\rho \frac{(1+s)^{\frac{\phi-\kappa\alpha+1}{\phi+1-\alpha}} + (1-s)^{\frac{\phi-\kappa\alpha+1}{\phi+1-\alpha}}}{\left((1+s)^{\frac{1-\kappa}{\phi+1-\alpha}} + (1-s)^{\frac{1-\kappa}{\phi+1-\alpha}}\right)^\alpha}
\end{aligned} \tag{14}$$

Table 4: *Reallocation in Planned and Market Economies (80s)*

	Planned Economies		Market Economies	
	East Germany	Soviet Russia Manu. Census	West Germany	USA
	1983-1988	1980 & 1988	1980-1988	1980-1988
Entry Rate	0.2%	1.4%	4.1%	9.4%
Exit Rate	0.8%	1.6%	4.2%	7.9%
Emp. Share young	1.8%	1.5%	3.5%	7.6%
JRR (Survivors)	3.0%	2.4%	9.2%	17.4%

Notes:Note: Average values across several years: East Germany (yellow): 1983-1988, Soviet Russia (red): 1980 & 1989 (estimates reflect the upper bounds), West Germany (light blue): 1980-1988, USA (blue): 1980-1988. Manufacturing sector (results for non-manufacturing sector are qualitatively similar). USA results as reported in Decker et al. (2020). 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 j in time t only for survivors for comparability of the Russian data set with the other countries.
Data: USSR manufacturing Census (Russia), GDR plan fulfillment survey (East Germany), IAB EHP (West Germany), US Census Bureau BDS (USA).

C.3 Labor demand and growth in multi-period model

In a multi-period model there are more than two types of firms, as each period firms are randomly receiving either positive or negative shocks, which creates a distribution of firm productivity. Labor market equilibrium is formulated as follows:

$$S = \int_0^M l_{jt} dj = \int_0^M \left(\frac{\alpha a_{jt}^{1-\kappa}}{w_t(1+\phi)} \right)^{\frac{1}{\phi+1-\alpha}} dj \tag{15}$$

Labor market equilibrium determines the equilibrium wage:

$$w_t^{\frac{1}{\phi+1-\alpha}} = 1/S \int_0^M \left(\frac{\alpha a_{jt}^{1-\kappa}}{1+\phi} \right)^{\frac{1}{\phi+1-\alpha}} dj \tag{16}$$

Hence, labor demand $l_{j,t}$ is defined as follows:

$$l_{jt} = \frac{(\alpha a_{jt}^{1-\kappa})^{\frac{1}{\phi+1-\alpha}}}{w_t^{\frac{1}{\phi+1-\alpha}}} = \frac{((a_{jt-1}^{\rho}(1 \pm s))^{1-\kappa})^{\frac{1}{\phi+1-\alpha}}}{1/S \int_0^M (a_{jt}^{1-\kappa})^{\frac{1}{\phi+1-\alpha}} dj} \tag{17}$$

Table 5: *Productivity Shocks and Firms' Responses*

Panel A: Productivity Persistence & Shocks

Dependent variable: labor productivity in $t+1$, $a_{j,t+1}$

	Planned Economies		Market Economies		
	GDR 1985-1988	Soviet Russia 1985-1988	West Germany 1995-2000	USA 1997-2013	USA (TFPS) 1980-1989
Labor productivity $a_{j,t}$	0.963***	0.9737***	0.9005***	0.7***	0.8***
	(0.0053)	(0.0018)	(0.0045)	(?)	(?)
SD of residuals (η)	0.12	0.13	0.22	0.31	0.31
Obs. (1000)	6.766	21.349	56.074	58,700	?

Panel B: Responsiveness

Dependent variable: employment growth, $g(l)_{j,t+1}$

	Planned Economies		Market Economies		
	GDR 1985-1988	Soviet Russia 1985-1988	West Germany 1995-2000	USA 1997-2013	USA (TFPS) 1980-1989
Labor productivity ($a_{j,t}$)	0.0017	.0061	0.0357***	0.2762***	0.2859***
	(0.0014)	(0.0039)	(0.0102)	(0.0003)	(0.0095)
SD of residual ($u_{j,t}$)	0.08	0.1			
Obs. (1000)	6.766	21.349	56.074	58,700	?

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. *Note:* Unit of observation: harmonized firm identifiers. USA results as reported in (Decker et al., 2020); the preferred estimate for the USA, reported on the graph, is based on labor productivity (as the estimates for all other countries) and covers 1997-2013, the second estimate, reported in the table, is based on the TFPS and covers 1980s, both estimates paint similar picture of persistence and responsiveness in the USA.
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 2.2 and in even more detail in Appendix A.

From that employment growth is derived (FE_t is a firm-invariant component)

$$\frac{l_{jt}}{l_{j,t-1}} = \frac{((a^{\rho}_{jt-1}(1 \pm s))^{1-\kappa})^{\frac{1}{\phi+1-\alpha}}}{1/S\int_0^M (a^{1-\kappa}_{jt})^{\frac{1}{\phi+1-\alpha}}dj} \Big/ l_{j,t-1} = \frac{((a^{\rho}_{jt-1}(1 \pm s))^{1-\kappa})^{\frac{1}{\phi+1-\alpha}}}{FE_t} \Big/ l_{j,t-1} \tag{18}$$

D 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:

$$g_{j,t} = \beta_0 + \beta_1(\omega_{j,t} - \omega_{j,t-1}) + \beta_2 e_{j,t} + X_j\Theta + \eta_{j,t} \tag{19}$$

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.

E Alternative Simulation Specifications

E.1 Problem description

We use a weighted least squares representation of the β estimates: The overall estimated is the weighted average of the estimates of the different subgroups:

$$\beta = \beta_{1-19\times young} * W_{1-19\times young} + \beta_{20-99\times young} * W_{20-99\times young} + \dots \tag{20}$$

The theoretically appropriate weights would be the inverse variance covarianace matrix, which we do not have (and the β is the vector of all coefficients). Thus, we have to use the "size" of the various groups.

However, even if W_* is know, this is still an equation with as many unknowns as the number of categories.

E.2 Young vs Mature

To solve this, first consider only the mature - young split:

- Potential size weights for each group:
  - share of young firms in economy in 1985 (when blackwood et al was estimated): 9% + 9%*0.75 + 9%*0.75*0.9 + 9%*0.75*0.9*0.9 + 9%*0.75*0.9*0.9*0.9 + 9%*0.75*0.9*0.9*0.9*0.9 = 36.6%
  - share of employment in young firms in economy in 1985 (when blackwood et al was estimated): 8.08%
  - share of young firms in economy 2000 (when decker et al estimation was made): 29%

Picking any of these solves the weights. However, there are still two unknowns:

$$0.075 = \beta_{young} * W_{young} + \beta_{mature} * W_{mature} \tag{21}$$

Thus, we assume that $\frac{\beta_{young}}{\beta_{mature}} = 1.29041316$, the same as in Decker et al. (2020). This yields, depending on the choice of weights:

- For 1980 employment weights: $0.075 = \beta_{mature} * 1.29041316 * 0.0808 + \beta_{mature} * (1 - 0.0808)$, i.e.$\beta_{young} = 0.09456$ and $\beta_{mature} = 0.0732804$
- For 1980 observation weights: $0.075 = \beta_{mature} * 1.29041316 * 0.366 + \beta_{mature} * (1 - 0.366)$, i.e.$\beta_{young} = 0.0875$ and $\beta_{mature} = 0.0678$
- etc

E.3 Size Classes

nr. of firms in size classes - Method 1:

- firm size categories in 1985 for young (BDS):
  - 504095+1223313 = nr of smallest firms
  - 512394+1310808 = nr of all firms
  - 95794 = nr of other firms
- responsiveness ratio west germany between size classes for young = 10/((4.8+2.8)/2) =2.632:
  - β_{other}*2.632 * (504095+1223313) + β_{other}*95794 = 0.0875
  - β_{other} = 0.034
  - $\beta_{smallest}$ = 0.089
- firm size categories in 1985 for mature (BDS):
  - 481695+1433850 = nr of smallest firms
  - 529790+1719953 = nr of all firms
  - 334198 = nr of other firms
- responsiveness ratio west germany for mature = = 10/((3.9+2.4)/2) =3.175:
  - β_{other}*3.175 * (481695+1433850)/(529790+1719953) + β_{other}*334198/(529790+1719953) = 0.0678
  - β_{other} = 0.052
  - $\beta_{smallest}$ = 0.164

l weights - Method 2:

- employment in categories in 1985 for young (BDS)::
  - 2083486+5575566 =7659052 = employment in smallest firms
  - 2941592 + 11005227 =13946819= employment in all firms
  - 6287767 = employment in other firms

- responsiveness ratio west germany between size classes for young = 10/((4.8+2.8)/2) =2.632:
  - β_{other}*2.632 * (7659052/13946819) + β_{other}*(6287767/13946819) = 0.0875
  - β_{other} = 0.046
  - $\beta_{smallest}$ = 0.121
- employment in categories in 1985 for mature (BDS):
  - 2370574+8085486 = 10456060=employment in smallest firms
  - 5505333 + 62126672 =67632005= employment in all firms
  - 57175945 = employment in other firms
- responsiveness ratio west germany for mature = = 10/((3.9+2.4)/2) =3.175:
  - β_{other}*3.175 * (10456060/67632005) + β_{other}*(57175945/67632005) = 0.0678
  - β_{other} = 0.051
  - $\beta_{smallest}$ = 0.162

So mature very small firms are even more agile than young ones??? somewhere we have to do it differently