A "Marginal" Tale of Two Germanies: Accounting for the Systemic Divide

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Abstract

The comparative economic performance between the former socialist German Democratic Republic (GDR) and the capitalist Federal Republic of Germany (FRG) remains inconclusive due to valuation problems. We address these problems by applying wedge-growth accounting to a newly compiled dataset. More precisely, we compare the allocation efficiency using wedges between marginal utility and productivity, as well as Total Factor Productivity (TFP) growth. Wedges in marginal utility account for binding quantity constraints in GDR's goods and FRG's labor market. We analyze the resulting unitless wedges and swap them in an equivalent growth model for the two Germanies to quantify their impact on output and economic welfare. The analysis reveals that the consequences of GDR's rationing were multiple times more drastic than FRG's unemployment. An observed faster output growth in the GDR stems from excessive labor input—depressing consumption-based welfare by a fourth—rather than from physical capital or TFP. Instead, GDR's economic activity fell comparatively ten years further behind due to lower TFP growth. Lastly, persistent, substantial net inflows increase GDR's welfare by 25 %.

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1 Introduction

After World War II, Germany was divided 1949 into two distinct political and economic systems that endured for four decades: the socialist, centrally planned German Democratic Republic (GDR) and the capitalist, market-oriented Federal Republic of Germany (FRG). While ample qualitative evidence shows a higher standard of living in the FRG relative to the GDR, reflected, e.g., in a wider variety of goods, the quantitative extent of this disparity in the standard of living remains uncertain due to issues in purchasing power parity (PPP) valuation. These issues arise from a lack of comparable consumer baskets and the non-convertibility of the GDR currency. Furthermore, quantitative evidence indicates that, in the latter three-quarters of the GDR's existence, per capita output growth exceeded that of the FRG (Gregory and Leptin, 1977; Heske, 2009). This faster growth raises questions about whether disparities in living standards stem from initial economic conditions or persistent systemic disadvantages in the GDR. Quantifying these disparities and uncovering their origin is essential not only to German economic history, but also to exploiting the unique natural experiment of Germany's separation—both as a representation of the broader divisions of Europe's past and as a means of understanding the long-term effects of divergent economic systems (Fuchs-Schündeln and Hassan, 2016; Becker et al., 2020).[1]

This study addresses the challenges inherent in these research questions by applying the wedge-growth accounting methodology (Chari et al., 2007). This quantitative approach is unitless—that is, free from currency rates and price levels—and therefore circumvents the issues associated with PPP valuation. The method enables us to compare distortions in resource allocation—referred to as "wedges"—and assess their impact on economic activity and welfare in both the GDR and the FRG. In doing so, we contribute to broader debates on the allocative and productive efficiency of planned versus market-oriented systems.

The implementation of this approach involves the construction of a consistent dataset of national accounts in real terms for both countries from 1960 to 1989, based on local prices and currencies. The dataset includes expenditure accounts, capital accounts (physical and human), hours worked, and employment.[2] A novel aspect of our dataset is constructing the physical capital stock for the GDR based on a stock check from the Federal Statistical Office of Germany at the time of reunification (Schmalwasser, 2001). This methodology

[1] The debate extends beyond economics to political issues, particularly regarding the social recognition of the GDR's achievements, which continue to influence the more extreme political preferences in the region of the former GDR.

[2] The data is available upon request.

marks a profound advancement in accurately estimating the GDR's capital stock.[3]

To quantify the misallocation of resources in both Germanies, we derive our measures—the wedges—from marginal utility and productivity of households and producers. Specifically, we define the ratio of the realized marginal rate of substitution between consumption and leisure and the realized marginal product of labor as labor wedge. In the same manner, we define the ratio of the realized intertemporal marginal rate of substitution of consumption and the realized return on investment as capital wedge. Additionally, we map quantity constraints in the demand for consumption goods and labor supply toward wedges between constrained-realized and unconstrained-desired marginal utility, scaling the wedges measured at the realized quantities. In this way, we necessarily account for two well-known facts: rationing in the GDR and unemployment in the FRG. Besides that, we define the expenditure subaggregates government consumption and net outflows as government spending wedge and residual demand wedge, respectively. With these two wedges in the resource constraint, we account for different signs in net outflows between the two countries. Further, we measure productivity with human capital adjusted Total Factor Productivity (TFP) (productivity wedge). We account for human capital to reflect two opposing forces: the GDR's emphasis on education and the emigration of young, educated workers before the construction of the Berlin Wall in 1961. In general, the model structure allows for accounting for important initial or pre-existing differences beyond human capital, e.g., in capital intensity or the capital stock (Gregory and Leptin, 1977; Becker et al., 2020).

The wedges representing ratios of the realized marginal rates are inherently independent of the price level and currency. We extend this independence to the remaining wedges by considering TFP relative to the initial TFP and expressing government consumption and net outflows as ratios to Gross Domestic Product (GDP). This ensures that the wedge accounting exercise is completely unitless, highlighting the major advantage of this approach.

At first glance, modeling wedges as the ratio of marginal rates from households and producers might seem inappropriate for a planned economy. However, welfare economics demonstrates that an allocation is efficient when marginal benefit equals marginal cost, i.e., when the labor and capital wedges equal one, regardless of whether resources are al-

[3]To the best of our knowledge, Glitz and Meyersson (2020) construct the most recent estimate of GDR's capital stock, assuming that by 1950, the capital stock had reached a balanced growth path. This assumption is incompatible with significant war destruction and the dismantling of large parts of the GDR's industrial capital by the Soviet Union in the immediate post-war years.

located through market forces, central planning, or any other means. Thus, these wedges quantify the distortion relative to an efficient allocation, regardless of the allocation mechanism.[4]

A comparison of the wedges between the GDR and the FRG highlights the segments of the economy where allocations are comparatively excessive or insufficient. Using a dynamic general equilibrium model, we construct counterfactual scenarios to quantify the impact of differences in resource allocation and technological change. Specifically, we swap individual wedges between economies, converting differences between unitless measures into differences in economic activity and welfare. While this approach does not indicate any causality of the underlying drivers, it quantifies the misallocations and their origins in the two Germanies. This enables an empirical marginalist system comparison of two real-world—thus imperfect—market and planned economies. In this regard, our analysis goes beyond the two typical welfare-economics comparisons: immanent (same system, perfect versus imperfect) and conceptual (perfect planner versus perfect markets). For example, we quantify the impacts of systemic differences such as guaranteed and coincidentally enforced employment versus competitive and coincidentally free labor markets or distinctions in business cycle dynamics.

We find that the GDR relied extensively on labor input compared to physical capital, contrasting the FRG. Furthermore, labor supply constraints in the FRG caused labor market distortions that were only a fifth as severe as those resulting from consumption composition constraints in the GDR. We find that, irrespective of the PPP conversion rate from the literature (0.5 – 1) used, the GDR's TFP endowment in 1960 was only a fraction of the FRG's (0.25 – 0.33), providing many opportunities to catch up to the FRG's productivity frontier. However, the GDR's TFP fell even further behind over time, indicated by a lower average TFP growth rate. Notably, if the GDR had followed the TFP growth of the FRG, its real GDP per capita by 1980 would have equaled the observed peak at the advent of reunification nearly a decade later. Furthermore, we observe substantial net inflows into the GDR until the early 1980s, which facilitated a high consumption-to-GDP ratio during this period.

A welfare analysis of the period suggests that if the FRG's observed TFP growth rates had applied to the GDR, it would have resulted in an equivalent increase of 13 % in (govern-

[4]Notably, we calculate the wedges solely using empirical quantities, a production function, marginal rates of utility and production, and the resource constraint. This approach eliminates the need for additional assumptions, such as optimizing agents or no-Ponzi conditions.

mental and private) consumption in the GDR. Conversely, if the GDR had not experienced any TFP growth, it would have incurred a 26 % welfare loss in terms of consumption equivalence. Moreover, GDR's welfare in the FRG's labor wedge counterfactual is up to nearly 40 % higher, emphasizing the excessive labor input in the GDR. The value of the large inflows to the GDR is equivalent to 25 % of consumption. Lastly, the welfare analysis indicates a loss of 15 % of consumption equivalence for the GDR in the counterfactual exercise with FRG's capital wedge during the period under consideration. However, this welfare loss diminishes over the long term, falling to 3 %. These insights are not apparent in a purely descriptive analysis. Recall the evidence of faster per capita output growth in the GDR, which, as our findings now reveal, incorrectly suggests superior economic prosperity in the GDR.

In summary, the wedge analysis suggests outcomes consistent with an economic policy in the GDR that was comparatively focused on immediate consumption of goods, with high saturation, at the expense of leisure, future consumption, and desired goods. An on average lower Solow residual growth rate in the GDR indicates that its faster human capital accumulation could not offset the persistent lower TFP growth. Given this generally lower productivity performance in the GDR, it seems unlikely that the GDR would have caught up to the FRG's GDP in the long run, despite faster growth in the medium term. This suggests that planners in the GDR concentrated too heavily on achieving specific production targets while neglecting or failing to make an efficient and productive use of inputs that is crucial for sustainable long-term economic development. We finalize our analysis with a short discussion on GDR's monetary policy wedge, indicating a persistent monetary policy below the neutral interest rate. The robustness of all these findings is confirmed through sensitivity analysis, which considers variations in time and leisure preferences, in welfare measurement, human capital, quantity constraints, utility from government consumption, and empirical physical capital measurements.

Our study builds on and extends several strands of literature. Chari et al. (2007) pioneered the approach of accounting for market distortions through wedges and using them to calculate counterfactuals. While Chari et al. (2007) focused on business cycle frequencies (business cycle accounting), Lu (2012) and del Río and Lores (2021) adapted the framework for medium-run analyses (wedge-growth accounting), which we follow. Lu (2012) incorporated human capital into this framework, following the approach of Hall and Jones (1999). Cheremukhin et al. (2017) and Cheremukhin et al. (2024) apply a quantity-constraint wedge accounting framework to study the industrialization and policy cycles of command economies with rationing, specifically Soviet Russia and mainland China. Despite that, in those cases, comparable decentralized economies are missing, Zhuravskaya et al. (2024) emphasize the general usefulness of the wedge accounting approach to study command economies. Fehrle and Konysev (2025) use the quantity constraint on labor supply wedge to examine unemployment in their study of the integration of the GDR into the FRG from 1990 onward within the wedge-growth accounting framework. Fisher and Hornstein (2002) study the period surrounding the advent of World War II in Germany in a similar framework—measuring distortions between marginal conditions within the neoclassical growth model.

Our quantity constraints map onto the model of rationing and quantity constraints from Howard (1977), aligning with the framework proposed by Barro and Grossman (1971). Plassard and Renault (2023) underscore the importance of incorporating consumption and labor quantity constraints in general equilibrium when assessing the historical experiences of Eastern and Western Europe, while Barro (2025) reaffirms the broader relevance of quantity constraints in general equilibrium settings. Similar to our constraint wedges, Indarte et al. (2025) map liquidity constraints into a wedge in the household's marginal rate of intertemporal substitution—captured, in turn, in our framework by the reduced-form capital wedge.

A strand of literature attempts to convert economic activity measures in the GDR before 1990 into prices and currency of the FRG (e.g., Merkel and Wahl, 1991; Schwarzer, 1999; Heske, 2009). However, due to the lack of comparable goods and observable currency exchange rates, these attempts are fraught with uncertainty. For instance, Schwarzer (1999) reports exchange rates for 1987 ranging from 0.45 to 0.85, which is just a subset of the broader range found in the literature. Therefore, relying on PPP conversion rates instead of unitless variables introduces a degree of freedom that adds arbitrariness to these attempts. As a workaround, Sleifer (2006) uses units of goods in the industry to compare the development of the two Germanies, avoiding the estimation of PPP conversion rates. However, this approach excludes services, which introduces biases given the substantial structural changes over time and the differences between the two Germanies (see also Heske, 2009, Chapter 17). Dietzenbacher and Wagener (1999) addresses another valuation problem that arises for price-weighted aggregators due to the price-setting differences between planned and market economies. They employ Seton's eigensystems (see Seton, 1985) to test the hypothesis that planned prices do not reflect relative scarcities. Their findings show no significant disparities between the GDR and the FRG in the late 1980s and conclude that aggregators from the GDR should be treated similarly to those from the FRG.

Our paper relates to the literature on the allocative and productive efficiency in real-existing planned economies. Ofer (1987) finds extensive growth in labor and capital inputs in the Soviet Union—the GDR's "Big Brother"—from 1928 to 1985. Easterly and Fischer (1994) argue that the decline of the Soviet Union during the period 1960 – 1989, which overlaps with the period we examine, was driven by technological factors, including output and substitution elasticities. Voskoboynikov (2021) finds extensive growth concerning capital inputs during the last 15 years of the Soviet Union using standard growth accounting.[5] Kukić (2018) applies business cycle accounting to former socialist Yugoslavia and finds a doubling in TFP and a halving of the labor wedge from the 1950s to the 1980s. Further, the capital wedge is constant from the 1950s to the 1970s and drops to 50 % of the initial value during the 1980s. Kukić (2018) does not account for levels in his analysis, as a comparative market economy does not exist. Kukić (2020) applies standard growth accounting for federal states and autonomous provinces of former socialist Yugoslavia and finds that the poorer regions did not catch up in TFP and employment rates. Glitz and Meyersson (2020) examine exotic attempts to increase TFP in the GDR: they assess the gains resulting from GDR's technological espionage in the FRG, They estimate that espionage contributed to a 20 % higher TFP in the GDR at the time of reunification. To abstract from the Soviet sphere, Bergh et al. (2025) focus their comparative study on post-colonial countries. For this sample, they find that socialism is associated with a two percentage point lower GDP per capita growth and an even larger gap in labor productivity growth, around ten percent greater.

Finally, the history of segregation and reunification in Germany serves as a frequently used natural experiment to examine the long-run effects of two political systems (Fuchs-Schündeln and Hassan, 2016). Becker et al. (2020) critically review the literature by revisiting the argument of Gregory and Leptin (1977), who claim that the ceteris paribus assumption does not hold when comparing the economic outcomes of the two systems with two Germanies, emphasizing the need to account for several key differences. Especially before the construction of the Berlin Wall in 1961, the GDR experienced a substantial exodus and negative population growth. Additionally, the GDR experienced a significant

[5] While Voskoboynikov (2021) concludes that TFP is the main determinant of labor productivity growth, we conclude his results—growth in capital intensity of 5.57 % and 4.66 % as well as TFP 1.17 % and –0.6 % leading to labor productivity growth of 2.84 % and 0.79 % from 1974 to 1985 and from 1986 to 1990—indicate excessive capital input (see also Voskoboynikov, 2021, Figure 3 and Table 1).

loss of physical capital due to industrial dismantling and the relocation of assets to the Soviet Union or businesses to the FRG. As a result, its capital stock declined by up to 50 % compared to 1943, while the FRG experienced a loss of only 25 %. Even before Nazi Germany (in 1925), the area that would become the GDR already had a higher share of manufacturing and blue-collar workers, reflecting an existing industrial focus.

The remainder of this paper reads as follows. We first discuss our data, focusing on the GDR. Afterward, we present the framework from which we derive the marginal conditions, TFP, and further unitless measures. In Section 4, we conduct the empirical exercises, i.e., measuring the wedges, and afterward, we compare them by analyzing the counterfactual outcomes. We then perform a sensitivity analysis and discuss our results. Finally, the paper concludes.

2 Data

In this section, we first discuss our data sources and the data preparation required for our analysis. We then argue against concerns regarding the quality of the GDR data, particularly skepticism about potential manipulation for propaganda purposes, and argue for its validity. Afterward, we explore the data descriptively. Generally, regarding the period under consideration, the final period is determined by the last year when both Germanies existed, 1989, the starting period by the reliability of primary sources, both for the GDR and the FRG, 1960.

2.1 Data processing

A deeper discussion of data processing is necessary for several reasons. Concerning the data for the GDR, some of our data is primarily from GDR's statistical office (Staatliche Zentralverwaltung für Statistik), which was not independent of the political system. Since the data for the FRG from 1960 until 1989 are from reliable sources[6] and our processing is minor, we put the equivalent discussion for the FRG in Appendix A.

Data Sources Our data on the national accounts and human capital of the GDR from 1960–1989 rely on various primary sources (Barro and Lee, 1993; Statistisches Bunde-

[6]The sources for the System of National Accounts (SNA) are the Federal Statistical Office of Germany, the statistical offices of the German states, the Institute for Employment Research (IAB) of the Federal Employment Agency (BA), and the Deutsche Bundesbank

samt, 1994, 2000; Schmalwasser, 2001; Sleifer, 2006; Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder", 2007; Heske, 2009). Specifically, Statistisches Bundesamt (2000) provides a comprehensive translation from Material Product System (MPS) to the System of National Accounts (SNA) (ESA 1995), yet only available in current prices and from 1970 to 1989. Heske (2009) expands large parts of the dataset provided by Statistisches Bundesamt (2000), offering data dating back to 1950 and converting them to constant prices (1995 Euro). Staatliche Zentralverwaltung für Statistik (1980) provides information for data that is not reported by Heske (2009)—mainly physical capital depreciation. Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2007) provides data on the capital stock of the area of GDR in 1991 based on ESA 1995. Schmalwasser (2001) provides a calculation sequence to translate the capital stock data from Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2007) to the capital stock of the GDR on the eve of the German reunification. Statistisches Bundesamt (1994) offers data from 1950 to 1989 regarding the labor force. Sleifer (2006) provides data on average hours worked per employee in the industry. Additionally, Barro and Lee (1993) provide data on the average years of school enrollment for the population of the GDR.

Data processing First, several data points are missing, notably concerning the SNA and labor force with years 1971, 1973, 1974, 1976, and 1977. Furthermore, there is a lack of data regarding the average hours worked in the industry for the year 1989. Lastly, the data from Barro and Lee (1993) is only available on a 5-year frequency. We interpolate missing data within the time series using cubic splines, while linearly extrapolate at the margins of the time series.

We present real values of all quantities in prices in Mark of the GDR (DDM) in 1989. Therefore, we construct real indices of private and government consumption, fixed investment, inventories, exports, and imports based on the real values from Heske (2009). Using the nominal values of these quantities from Statistisches Bundesamt (2000), we can express the quantities from 1960 to 1989 in prices of 1989. Based on the subaggregates of GDP usage, we calculate real GDP and net exports in prices of 1989 by simply summing them up. Note that the calculation of the underlying price indices allows a consistent aggregation by summing up.

We use the nominal deprecation values reported in Statistisches Bundesamt (2000) (1970–1989) and Staatliche Zentralverwaltung für Statistik (1980). In the latter, the elicitation method differs as these values do not include the depreciation in the public sector.

Thus, we use this data as a proxy to extrapolate the values reported in Statistisches Bundesamt (2000) by using the growth rates of the values reported in Staatliche Zentralverwaltung für Statistik (1980). This so-called transparent ratio-splicing approach is common practice (e.g., Müller et al., 2025). We deflate the nominal depreciation values with an investment-good deflator. This deflator is constructed with the nominal investment values reported in Statistisches Bundesamt (2000) (1970–1989) and a Heske (2009) consistent series from Staatliche Zentralverwaltung für Statistik (1980) (1960–1969) together with the real values (in prices in 1989) from Heske (2009). In the same way, we construct a consumption-good deflator.

To calculate the capital stock on the eve of the reunification, we use the capital stock based on the ESA 2005 reported in Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2007). Schmalwasser (2001) reports the construction of the value of the capital stock of the GDR for the ESA 2005 reform as follows: i.) Take the values of Staatliche Zentralverwaltung für Statistik (1990) in 1989, ii.) add the capital stock of the so-called "Sonderbereich", iii.) depreciate the part of the stock that is actually already depreciated or has a lifetime less than 20 % of the planned one, which equals 9 % of the buildings and 34 % of other structures, iv.) depreciate the part that becomes obsolete due to the reunification-induced structural change (15 % of the buildings and 31 % of other structures), v.) reevaluate in Deutsche Mark by factorizing buildings with factor 0.75 and other structures with 0.77. We define the usable capital stock on the eve of the reunification as the reported capital stock in Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2007) in Mark of the GDR plus the part of the capital stock that becomes obsolete due to the reunification-induced structural change. As the data are only reported for the former GDR without East Berlin, we assume that the capital stock per capita in East Berlin is the same as in the remaining part of the GDR. Thus, we multiply the reported capital stock of the "Neue Länder" in Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2007) by the population of the GDR over the population excluding East Berlin's population.

We construct a time series of the replacement value of the capital stock by applying the perpetual inventory method backward.

As a proxy for the average hours worked per employee in the economy, we take the data on average hours worked per employee in the industry from Sleifer (2006).

Data Quality We address data quality for multiple reasons. First, the statistical office of the GDR was influenced by the political system and utilized for propagandistic purposes. Given that a significant portion of our data stems from this source, ensuring reliability is important. Second, the creation of the deflators and other data components are not reported in English and were not released from an official statistical office. We want to give some insights into data creation and usability. Third, we discuss the effects of the inter- and extrapolation and the use of proxies. Fourth, parts of our data have undergone revisions over time. Regrettably, data concerning the GDR has not undergone these revision processes, leading to outdated primary sources. Finally, our database relies on various sources, so ensuring consistency is critical.

Concerning our first points, Glitz and Meyersson (2020) already discuss Statistisches Bundesamt (2000) and Heske (2009) for their use—a sectoral output compilation. We discuss the data in light of our purposes—the expenditure compilation. The SNA of Statistisches Bundesamt (2000) and Heske (2009) rely on data from the official statistical office of the GDR. However, most parts of the data creation are based on primary sources, which were only for internal use and labeled as "confidential" and, thus, not subject to manipulation for propaganda purposes.[7] Additionally, Glitz and Meyersson (2020) report a verification of the high validity of data from the statistical office of the GDR from FRG's Statistical Office. The data on current prices of the expenditure subaggregates in Statistisches Bundesamt (2000) (1970-1989) grounds at large on the same procedures as the West German SNA creation and is based on micro data from the production side—a bottom-up supply-side-oriented calculation approach. For the time before 1970, scarce data availability does not permit such a procedure. Heske (2009) calculates the subaggregates by adjusting the expenditure reports of the MPS. There is a serious difference in the interpretation of investment goods between SNA and MPS. The MPS reports the value of investments in the service sector as gross fixed investments, and in the non-service sectors as net fixed investments. Heske (2009) solves the problem by adding the amount of depreciation to investments. Despite the break in the data quality in 1970, the data before 1970 is sensible.

Heske (2009) calculates deflators on the grounds of price reports of the statistical office of the GDR. However, price changes that came with a new product were fully attributed to quality improvements by the statistical office in these reports. This linking ends in

[7] We give insights by providing two snippets each from one published and one classified report from the official statistical office of the GDR in Appendix A.2.

an underestimation of inflation. Heske (2009) estimates these biases to be one to two percentage points per year and adjusts the deflators by these factors.

We are somewhat more critical of the conversion into DM and EUR. Besides issues with finding suitable conversion rates, Heske (2009) converts the different subaggregates with different but time-fixed rates (in 1991). This combination pretends a non-existing comparability between the two Germanies and rules out aggregation. For example, net exports are mostly positive after the conversion in the 1980s, while always negative in constant prices in Mark of the GDR. However, since our approach does not rely on a comparison of values in the same currencies, the conversion problem is not subject to our study.

Regarding the problem of price-weighted aggregation in command economies, it should be noted that there is evidence that prices from the supply-side in the GDR and the FRG reflect scarcities similarly (Dietzenbacher and Wagener, 1999). Furthermore, similar studies on planned economies (e.g. Cheremukhin et al., 2017; Glitz and Meyersson, 2020; Cheremukhin et al., 2024) show that price-weighted aggregates in command economies provide valuable insights. Lastly, as correctly stated by Dietzenbacher and Wagener (1999), a similar problem occurs for price and quantity indices because the base year does not represent the scarcity of the current year, and these procedures are used without justification.[8]

We expect minor effects due to the interpolation of a period of up to two years. Further, as Barro and Lee (1993) calculate the average years of schooling with the perpetual inventory method, the evolution is smooth, so the effects of the interpolation are minor for average years of schooling.

We consider the accuracy of extrapolation of the depreciation values as high since, except for the depreciation in the public sector ($\approx 15\,\%$ of the depreciation), the primary data source is the same. Put another way, we only project the variation of the depreciation in the public sector by assuming the same rate of change for the public sector as for the private sector. Additionally, note that we calculated the capital stock backward from 1990. Hence, the extrapolation does not influence the data from 1970 onward.

Using the average annual hours worked per employee in the industry as a proxy for the total economy can be critical. However, industry workers represent a large fraction of the total labor force (between 45 % and 50 % of the labor force worked in the industry in the GDR between 1970 and 1989 (Statistisches Bundesamt, 2000)). Further, the decision on the weekly amount of hours worked was made by the government and, thus, we do

[8]Note that the modern use of chained indices tries to minimize such problems, yet at the cost of non-additivity of subaggregates.

not expect large differences between sectors, especially over time. Note that sticking only to the labor force—instead of hours worked—would be more misleading for the analysis of the FRG due to two counteracting facts. On the one hand, labor force expansion was driven by increasing female participation in the FRG throughout the analyzed period. On the other hand, a decline in average hours worked per worker resulted from a decrease in general weekly hours and a rise in part-time employment. Further, sticking only to the labor force implies the assumption of the same amount of hours worked per workforce between the two countries and sectors within a country.

Concerning data revisions, all data on national accounts follows SNA ESA 1995 and is, thus, internally consistent. Although ESA 1995 is not the most recent revision, there is no problem with this standard for our purposes, and there is no report for a more recent revision on the FRG data before 1991, either. There are several revisions on the data on the average years of school enrollment from Barro and Lee (1993) due to criticism for their construction (e.g., de la Fuente and Doménech, 2006; Cohen and Soto, 2007). However, the critique unfolds mainly on implausible results for individual countries. Since this is not the case for either of the two German countries, and we are not aware of any better data for the GDR, the work of Barro and Lee (1993) is the best available source for our purpose.

2.2 Data exploration

We plot our data for the GDR and the FRG in Figure 1. We avoid expressing any quantities in prices and currencies. Therefore, Panel (a) displays the GDP per capita for the GDR and the FRG, both normalized to one in 1960. There are different general growth trends between the GDR and the FRG from 1960 to 1989. The former's GDP per capita grew faster than the latter's (4.05 % versus 2.74 % on average p.a.). At the same time, as the population growth rates plotted in Panel (h) suggest, the population shrank by a yearly average rate of 0.12 % in the GDR and grew by 0.28 % in the FRG.

Panel (b) of Figure 1 plots the subaggregates private consumption (C), investments (I), government consumption (G), and the net outflows (the sum of net exports and inventories, ($Resid$)) relative to GDP. In both Germanies, private consumption accounts for the biggest share of GDP (52 – 64 %). The government consumption share in the GDR declines from 25 % to 20 %, meeting the rising one in the FRG in the mid-1980s. Both investment shares start at about 25 %. The one in the GDR rises to about 30 % from the late 1960s while FRG's investment share steadily declines to 20 % until 1989. In the FRG, net outflows are always between 0 – 10 % while in the GDR close to –20 % until the 1980s when they consolidate at approximately 0 %.[9] Except for investment in the early 1960s, where there are almost equal in both Germanies, the shares on GDP of the in-period domestic use subaggregates are higher in the GDR until the balance of the net inflows in the mid-1980s.

Concerning the gross capital-to-GDP ratio, panel (c) of Figure 1 plots the evolution of the capital stocks (relative to GDP), and panel (d) the depreciation rates. In the early–1960s, the capital stocks in both Germanies are around 650 % of GDP and decline steadily and similarly to approximately 500 % at the advent of the reunification. The depreciation rates are smaller than 1.5 % in the early 1960s in both Germanies and nearly 3 % at the advent of the reunification. However, the depreciation rate in the GDR increases faster (especially in the mid-1960s and 1970s) and reaches a peak of over 3 % in the late–1970s, whereas, in the FRG, it rises with a trend that is closer to be linear. The strong increase of the deprecation rate in the data of the GDR is in line with an in the GDR classified information on technological change that reports: "The age structure of machinery and equipment in the GDR is less favorable than in other highly developed industrialized countries (Staatliche Zentralverwaltung für Statistik, 1968, p. 7)" and that 44 % of the stock of machinery and equipment is older than 10 years (Staatliche Zentralverwaltung für Statistik, 1968, p. 8).

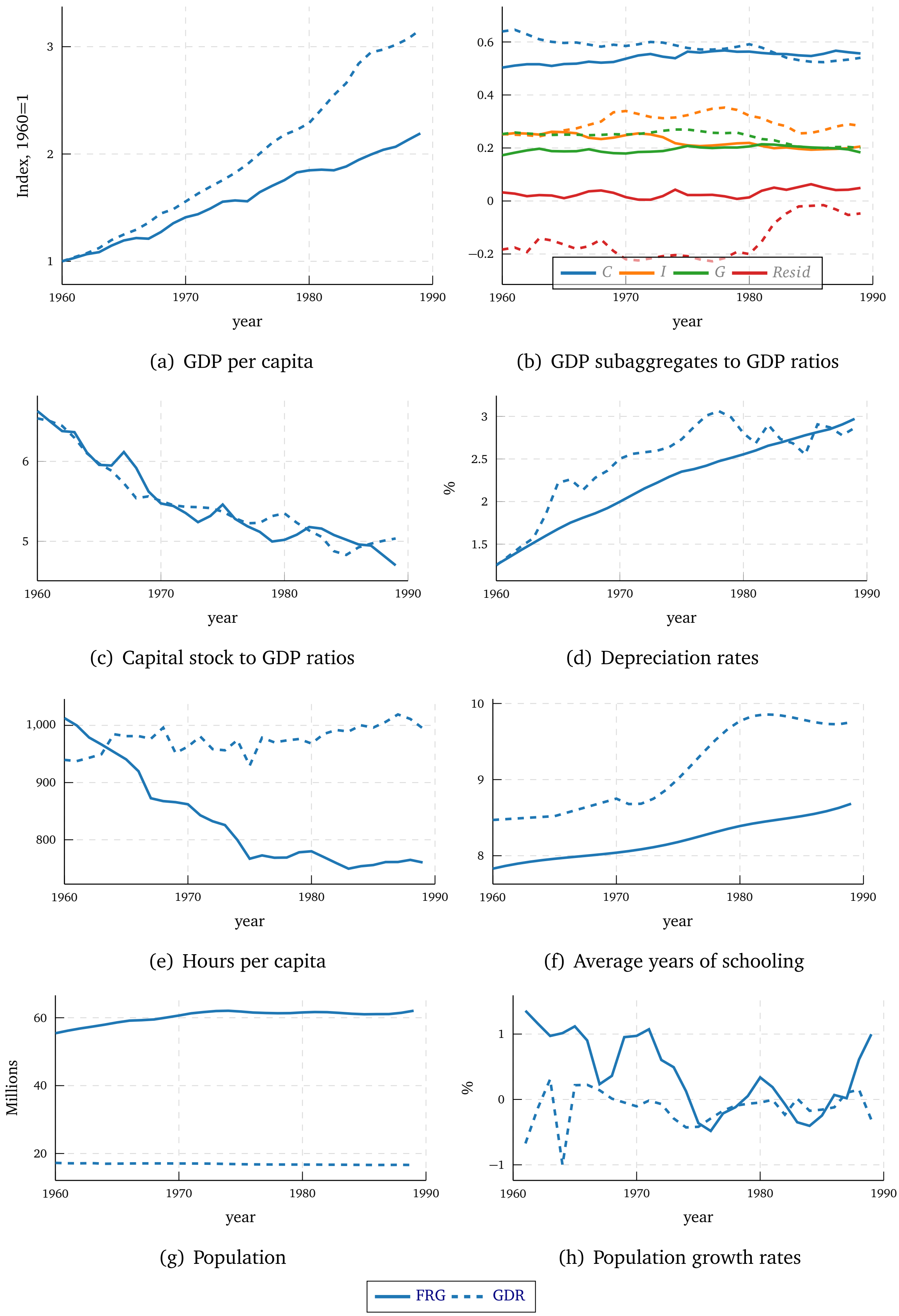
The presented capital-to-GDP ratios are comparatively high and, related, the depreciation rates low. This is due to the fact that we use the gross capital stock instead of the net capital stock, since the gross capital stock corresponds to the capital used for production, while the net capital stock expresses the present value of capital (see also Schmalwasser, 2001). However, we repeat our exercises with the more often used net capital stock as a robustness analysis.

Panel (e) of Figure 1 displays the hours worked per capita and panel (f) average years enrolled in school. Hours worked are around 1,000 hours a year in the FRG and around 60 hours a year higher than in the GDR in 1960. Until the mid-1970s, the amount of hours falls by 25 % in the FRG and remains stable at around 750 hours a year from there on. Hours worked remained stable or even increased around 50 hours in the GDR. Concerning average years enrolled in school, the FRG increases the average enrollment by around a year from close to 8 years in the early 1960s to close to 9 years. The population of the GDR

[9] Most of the inflows into the GDR had been commodities. The GDR's consolidation was forced by the stop to rollover GDR's debt and further changes in the lending policies from Western banks. The policies changed due to the financial difficulties of Poland and the USSR (Pohl, 1984, p. 46).

had an average plus of half a year of enrollment in school in the early 1960s compared to the FRG. This surplus increases by one year at the end of the 1980s.

Figure 1: Data



(a) GDP per capita

(b) GDP subaggregates to GDP ratios

(c) Capital stock to GDP ratios

(d) Depreciation rates

(e) Hours per capita

(f) Average years of schooling

(g) Population

(h) Population growth rates

3 THEORETICAL FRAMEWORK

Generally, the framework of our GDR and FRG model economies is identical. However, the values of the quantities, wedges, and parameter values can differ. In the following model description, all variables and parameters are indexed with $i \in \{E, W\}$ for the GDR (East Germany) and the FRG (West Germany), respectively. Time is indexed with t and represents one year. Capital letters represent total and lower cases represent per-capita quantities.

3.1 Representative Household

In each economy there exists an infinitely lived representative household. The number of household members N_{it} increases with time-varying factor g_{Nit}. The household receives utility from private and a per-capita share of government consumption (c_{it} and g_{it})[10] and leisure, which is the residual between the household's time endowment and time spent for work $\bar{l} - l_{it}$. The household discounts future utility with β_i ($0 < \beta_i < 1$). Thus, the household's lifetime utility reads $U_{i0} = \sum_{t=0}^{\infty} \beta_i^t N_{it} u(c_{it}, g_{it}, \bar{l} - l_{it})$, with $u_j > 0$, $u_{jj} < 0$, $j \in \{c_{it}, g_{it}, \bar{l} - l_{it}\}$.

3.2 Technology

Each economy is endowed with a technology $A_{it}F(K_{it}, h_{it}, L_{it})$ with $F_j > 0$, $F_{jj} < 0$, $j \in \{K_{it}, h_{it}, L_{it}\}$ and $\zeta F(K_{it}, h_{it}, L_{it}) = F(\zeta K_{it}, h_{it}, \zeta L_{it})$ to produce output Y_{it}, a homogeneous good. A_{it} represents TFP, K_{it} the physical capital stock, and h_{it} the human capital. Capital accumulates with the following law of motion $K_{it+1} = (1 - \delta_{it})K_{it} + I_{it}$, where I_{it} are investments ($I_{it} > 0$) and δ_{it} the time-varying depreciation rate ($0 < \delta_{it} < 1$). Human capital follows a function $h_{it}(s_{it})$ dependent on average years enrolled in school s_{it}.

3.3 Resource constraint

The economy faces a resource constraint. The constraint characterizes that the sum from private and government consumption, investment, and residual demand ($\omega_{it}^D Y_{it}$), which represents net outflows, has to be lower than or equal to output: $Y_{it} \geq C_{it} + G_{it} + I_{it} + \omega_{it}^D Y_{it}$.

[10]Government consumption reads like rival goods, as standard in the wedge-growth accounting literature (e.g. Fernández-Villaverde et al., 2023). A second reading is that non-rival goods of government consumption augment the utility function by one N_t-th of the rival goods of government consumption.

3.4 Efficient allocation

Equality between marginal costs and benefits satisfies the necessary conditions for a Pareto-efficient equilibrium. Hence, the allocation of labor is efficient once the marginal disutility from an additional unit of labor $-u_{l_{it}} = u_{\bar{l}-l_{it}}$—the costs—equals the marginal productivity from an additional unit of labor $F_{L_{it}}$ in marginal utility units $u_{c_{it}}$—the benefit. In the same manner, the allocation between today and next-period consumption is efficient, once the marginal utility from consumption today equals the return on investment tomorrow times discounted marginal utility tomorrow $(1-\delta_{it+1}+F_{K_{it+1}})\beta u_{c_{it+1}}$.

3.5 Inefficient allocation

Given an efficient allocation, the cost-to-benefit ratio must be one. Looking at it the other way around, the inefficiency of the allocation can be represented by a wedge, by calculating the deviation of the respective ratio from one. The labor wedge ω^L_{it} and capital wedge ω^K_{it} read:

$$\omega^L_{it} = \frac{u_{\bar{l}-l_{it}}/u_{c_{it}}}{F_{L_{it}}}, \tag{1}$$

$$\omega^K_{it+1} = \frac{u_{c_{it}}/(\beta u_{c_{it+1}})}{1-\delta_{it+1}+F_{K_{it+1}}}. \tag{2}$$

Note that a wedge larger than one acts like a subsidy and lower than one like a tax.

As the residual demand is neither augmenting utility nor production, it can be seen as waste, thus we can interpret ω^D_{it} as residual demand wedge representing net outflows as follows:[11]

$$(1-\omega^D_{it})Y_{it} = C_{it} + G_{it} + I_{it}. \tag{3}$$

In the same manner, we define a government consumption wedge as

$$\omega^G_{it} = \frac{G_{it}}{Y_{it}}, \tag{4}$$

coinciding with the marginal effect of output on government consumption. Further, we treat TFP as a productivity wedge ω^e_{it}. TFP can be interpreted as a proxy for the true

[11] As this waste is actually the net outflows and thus can get negative, by this, enlarging the available resources.

wedge: the distance of $A_{it} = \omega^e_{it}$ to a hypothetical period-t productivity frontier $\bar{A}_{it}$ as well as the marginal effect of a proportional change of input factors on output.

We introduce quantity constraint wedges to account for two well-known facts: excessive demand for consumption goods in the GDR—evident from ration queues—and excessive labor supply in the FRG—evident from high unemployment rates. We show that wedges in the marginal utility between an unconstrained and a constrained economy are equivalent to these constraints. Howard (1977) provides a full analysis of our sketch of a quantity-constrained economy. First, c_{it} represents a consumption aggregator $u(c_{it}) = u(C(c_{1it}, c_{2it}, ..., c_{Nit}))$ for N good types. Note that the aggregator remains the numéraire. It follows from maximization that the marginal utility–to–price ratio of all N good types equals the utility–to–price ratio of the aggregator and thus the marginal utility of aggregated consumption λ_{it} reads

$$u_{c_{it}} = u_{c_{1it}}/p_{1it} = u_{c_{2it}}/p_{2it} = ... = u_{c_{Nit}}/p_{Nit} = \lambda_{it}, \tag{5a}$$

where $p_{1it}, p_{2it}, ..., p_{Nit}$ represent the prices of different good types. This result changes once some good types are constrained in supply. In these cases, Kuhn-Tucker constraints bind and the Kuhn-Tucker multipliers become positive. For example, in the case of good c_{1it} is constrained, it follows

$$u_{C^{QC}_{it}} = (u_{c_{1it}} - \phi_{1it})/p_{1it} = u_{c_{2it}}/p_{2it} = ... = u_{c_{Nit}}/p_{Nit} = \lambda^{QC}_{it}, \tag{5b}$$

where ϕ_{1it} denotes the Kuhn-Tucker multiplier regarding good c_{1it} and superscript ^{QC} marginal utility from aggregated consumption with quantity constraints. Dividing (5b) by (5a) and rearranging gives

$$u_{c^{QC}_{it}} = \frac{\lambda^{QC}_{it}}{\lambda_{it}} u_{c_{it}}. \tag{5c}$$

We conclude that $\lambda^{QC}_{it}/\lambda_{it}$ acts like a wedge between the marginal utilities. Consequently, we can substitute the marginal utility of constrained consumption for a given c_{it} with the unconstrained for the same c_{it} times the wedge $\omega^{QC}_{it} = \lambda^{QC}_{it}/\lambda_{it} < 1 \forall t$.

Regarding labor demand quantity constraints on hours worked by the household, the first-order condition on realized labor supply reads

$$u_{\bar{l}-l_{it}} = \omega^L_{it} F_{iL_t} \lambda_{it}(1+\phi_{iLt}/\lambda_{it}),$$

where ϕ_{iLt} denotes the Kuhn-Tucker multiplier ($\phi_{iLt} < 0$)[12] for the demand-induced constraint on labor supply (in $\omega^L_{it} F_{iL_t}$ terms) and λ_{it} corresponding marginal utility of consumption.

Again, dividing by the unconstrained counterpart, indicated by superscript ^{UC}, and rearranging yields

$$\frac{1}{(1+\phi_{iLt}/\lambda_{it})} \frac{u_{\bar{l}-l_{it}}}{u_{c_{it}}} = \frac{u_{\bar{l}-l^{UC}_{it}}}{u_{C^{UC}_{it}}}.$$

Hence $1/(1+\phi_{iLt}/\lambda_{it})$ acts like the wedge ω^{QL}_{it} (quantity-constraint-on-labor wedge) between the realized marginal rate of substitution and the desired one for a given $\omega^L_{it} F_{iL_t}$.

In the case of aggregated underemployment—a Keynesian scenario—unemployment leads to effective quantity constraints in good supply (see Barro and Grossman, 1971; Barro, 2025). Such constraints can create an additional wedge between realized and desired marginal productivities. However, by adhering to the standard general equilibrium modeling assumption of constant returns to scale, optimal marginal productivity remains independent of output levels, even under quantity constraints. Thus, the wedge between realized and desired marginal productivities is always equal to one, and TFP is independent of quantity constraints.

Lastly, we do not include a wedge in the intertemporal marginal rate of substitution à la Indarte et al. (2025). While it is necessary to account for differences in marginal utilities arising from constraints within the consumption goods bundle and in labor in order to render the corresponding wedges comparable, no such adjustment is required for liquidity constraints and the capital wedge.

3.6 Parametrization

Our utility function follows Fernández-Villaverde et al. (2023) and reads $u = \ln(c_{it} + g_{it}) + \theta_i \ln(\bar{l} - l_{it})$. Assuming perfect substitution between private and government consumption generally removes the need to make additional assumptions about how planners allocate

[12] The definition of a negative Kuhn-Tucker multiplier follows Howard (1977). Note additionally that labor augments utility negatively.

these two forms of consumption in command economies or how government consumption differs in decentralized economies. However, we verify the robustness of our results to the contrary, government consumption being considered pure waste. The production function is Cobb-Douglas style: $Y_{it} = A_{it}K_{it}^{\alpha_i}(h_{it}L_{it})^{1-\alpha_i}$, $0 < \alpha_i < 1$. Again, the constant returns to scale offset the effects of good supply constraints on marginal productivity and TFP. Lastly, years enrolled in school s_{it} translates into log-human capital $\ln h_{it}$ as in Hall and Jones (1999): $4\gamma_1 + (s_{it} - 4)\gamma_2$ for $4 < s_{it} < 8$ and $4\gamma_1 + 4\gamma_2 + (s_{it} - 8)\gamma_3$ for $s_{it} > 8$, with $\gamma_1, \gamma_2, \gamma_3 > 0$.[13]

4 Measuring the wedges

In this section, we measure the wedges for both Germanies for the period 1960 to 1989, where the former corresponds to $t = 0$ and the latter to $t = T$. The realizations of the wedges $\{\omega_{it}^{e}, \omega_{it}^{L}, \omega_{it+1}^{K}, \omega_{it}^{D}, \omega_{it}^{G}\}_{t=0}^{T}$ can be computed using the observables $\{g_{it}, \delta_{it}, h_{it}, g_{Nit+1}, y_{it}, c_{it}, l_{it}, k_{it+1}\}_{t=0}^{T}$ and the initial capital stock k_{i0}, once the parameter values are calibrated and the quantity constraint wedges $\{\omega_{it}^{QC}, \omega_{it}^{QL}\}_{t=0}^{T}$ are determined. More to the point, given our parametrization, we measure the former set of wedges as follows:

$$\omega_{it}^{L} = \frac{\omega_{it}^{QL}}{\omega_{it}^{QC}} \frac{\theta_i}{1-\alpha_i} \frac{(c_{it} + g_{it})}{\bar{l} - l_{it}} \frac{l_{it}}{y_{it}}, \tag{6a}$$

$$\omega_{it+1}^{K} = \frac{1}{\beta_i} \frac{c_{it+1} + g_{it+1}}{c_{it} + g_{it}} \frac{\omega_{it}^{QC}}{\omega_{it+1}^{QC}} \left(1 - \delta_{it+1} + \alpha_i \frac{y_{it+1}}{k_{it+1}}\right)^{-1}, \tag{6b}$$

$$\omega_{it}^{e} = \frac{y_{it}}{k_{it}^{\alpha_i}(h_{it}l_{it})^{1-\alpha_i}}, \tag{6c}$$

$$\omega_{it}^{D} = \frac{y_{it} - c_{it} - g_{it} - (g_{Nit+1}k_{it+1} - (1-\delta_{it})k_{it})}{y_{it}}, \tag{6d}$$

$$\omega_{it}^{G} = \frac{g_{it}}{y_{it}}. \tag{6e}$$

We next describe our calibration exercises and the strategy to determine the quantity constraint wedges. Afterward, we present the resulting wedges and discuss their trajectories and sensitivity to the calibration.

[13] Lu (2012) introduced this to wedge-growth accounting exercises.

4.1 Calibration

We pin down the parameter values for $\beta_i, \theta_i, \bar{l}, \alpha_i, \gamma_1, \gamma_2$, and γ_3 as summarized in Table 1.

There is strong evidence of differences in the technology parameters between the GDR and FRG. We account for this heterogeneity by using the values from Glitz and Meyersson (2020), $\alpha_E = 0.399$ and $\alpha_W = 0.282$. Glitz and Meyersson (2020) use the average capital shares in value added between 1995 and 2006 of the ten new European Union members (accede in May 2004) as a proxy to calculate the output elasticity of capital for the GDR and use the capital share in value added of the FRG between 1970 and 1989 for its output elasticity of capital. For comparison, Sleifer (2006) reports an output elasticity of capital for the German Empire in 1936 equal to 0.55, Heer and Maußner (2009, Ch. 1.5.2) equal to 0.27 for the FRG from 1975–1989, and Heer and Maußner (2024, Ch. 1.6.2) equal to 0.36 for the reunified Germany from 1991–2019.

There are hypotheses on system-shaped preferences during the segregation and different population characteristics between the GDR and the FRG before 1960, leading to preference heterogeneity between them (see Becker et al., 2020). The drivers behind system-shaped preferences remain unclear to us, e.g., a persistent wedge could drive habits but not long-run preferences. Additionally, regarding the early 1960s, system-shaped preference heterogeneity should not be fully arisen. Regarding the late 1980s, Friehe and Pannenberg (2020) find homogeneity in patience, i.e. our parameters β_i, between GDR and FRG citizens and findings of Burda and Hunt (2001), Burda (2008), and Dohmen et al. (2011) suggest preference homogeneity for the reunified Germany. The reasons for differences in economic outcomes and population characteristics are multifactorial, e.g., they could be grounded in different institutions, which reflect in different wedges. Thus, we stick to preference homogeneity but will discuss the effects of potential preference heterogeneity at the respective wedges.

Consequently, we set identical preference parameter values for the GDR and the FRG, namely $\theta_E = \theta_W$ and $\beta_E = \beta_W$. Regarding the calibration, we follow Heer and Maußner (2009, Ch. 1.5.2) for the FRG during 1975 – 1989, resulting in $\beta_i = 0.985$, and measure leisure preferences at a time endowment per capita $\bar{l}$ of 16 hours a day times 90 days per quarter and four quarters per year, resulting in $\theta_i = 6$.

This calibration exercise on the preference parameters relies on long-run averages of economic variable levels and ratios, which reflect the long-run behavior of specific terms in equation (6). Here, the non-quantity constraint-adjusted capital and labor wedges are omitted in the long run, due to indeterminacy between these wedges and the parameters β_W and θ_W (see also Ohanian et al., 2018). While this sounds problematic, for given quantity-constraint wedges and homogeneous preferences, it affects only the level of the wedges, not the relative differences between the two Germanies, which are the primary focus of our analysis (see also Fernández-Villaverde et al., 2023). Moreover, the indeterminacy implies that changes in the preference parameters cause reciprocal changes in the wedges' average level. Consequently, most of our chosen counterfactuals—specifically, the wedges representing the other Germany—result in counterfactual quantities that are independent of preference parameters, again for given quantity constraint wedges and provided preferences are homogeneous. However, naturally, our welfare measure is sensitive to the choice of preference parameters and the levels of the wedges. We discuss the effects of preference heterogeneity and, in particular, homogeneous changes in parameter values in detail throughout our analysis and robustness checks.

Consistent with the wedge-growth accounting exercise of Lu (2012), the parameter values regarding the evolution of human capital are from Hall and Jones (1999) and are: $\gamma_1 = 0.134$, $\gamma_2 = 0.101$, $\gamma_3 = 0.068$.

Table 1: Summary of calibration

Parameter	Value		Description
	GDR	FRG	
α	0.399	0.282	Capital share in production
β	0.9847		Discount factor
θ	6		Preference for leisure
$\bar{l}$	5760		Time endowment (hours/year per capita)
k_{1960}	40875	114430	Real capital stock per capita in 1960
γ_1	0.134		Mincerian return on primary educ. (1-4 years)
γ_2	0.101		Mincerian return on secondary educ. (5-8 years)
γ_3	0.068		Mincerian return on tertiary educ. (>8 years)

Notes: Level magnitudes k_{i1960} are valued by constant local prices: By the domestic currency Ostmark (DDM) in 1989 in the GDR and by the Deutsche Mark (DEM) in 1989 in the FRG.

4.2 Quantity constraint wedges

To pin down the quantity-constraint wedges, we set first $\omega^{QC}_{Wt} = 1$ and $\omega^{QL}_{Et} = 1$ for all t, meaning there are no quantity-constrained consumption goods in the FRG and zero unemployment in the GDR.

Our strategy to quantify the quantity-constraint-on-labor wedge follows Fehrle and Konysev (2025). We identify the desired additional hours worked in the FRG by revealed preferences—registered job-seekers.[14] We assume that a registered job-seeker wants to work the average working hours of the working population. Therefore, we calculate the unconstrained working hours by $l^{UC}_{Wt} = l_{Wt}(1 + \frac{uq_{Wt}}{1-uq_{Wt}})$, where uq_{Wt} represents the fraction of registered job-seekers on the total labor force. Consequently, the additional desired working hours read $l^a_{Wt} = l^{UC}_{Wt} - l_{Wt}$. Further, we assume that a fraction, denoted by χ_W, of the additional income from work of the unemployed members of the household, $\omega^L_{WT} F_{lWt} l^a_{Wt}$, is allocated to additional consumption c^a_{Wt}. Thus, χ_W representing the marginal propensity to consume from income earned through (additional) employment. We then derive from the unconstrained counterfactual the quantity-constraint-on-labor wedge as follows: [15]

$$
\begin{aligned}
\theta \frac{c_{Wt} + g_{Wt} + c^a_{Wt}}{\bar{l} - l_{Wt} - l^a_{Wt}} &= \omega^L_{Wt} F_{lWt} \\
\Leftrightarrow \theta \frac{c_{Wt} + g_{Wt}}{\bar{l} - l_{Wt}} &= \omega^L_{Wt} F_{lWt} \left(1 - \frac{l^a_{Wt}}{\bar{l} - l_{Wt}} (1 + \chi_W \theta) \right) \\
\Leftrightarrow \omega^{QL}_{Wt} &= \left(1 - \frac{l_{Wt}}{\bar{l} - l_{Wt}} \frac{uq_{Wt}}{1 - uq_{Wt}} (1 + \chi_W \theta) \right)^{-1}.
\end{aligned}
$$

We take the value for the marginal propensity to consume χ_W from Fehrle and Konysev (2025), which equals 0.58, and the unemployment rate uq_{Wt} from the official FRG labor statistics. Figure A.13 in Appendix E illustrates the additional, unconstrained hours worked compared to the actual hours worked.

Regarding the wedge of marginal utility from constraint consumption, we compare the marginal utility at market-clearing prices along the indifference curve with marginal utility at the quantity-constrained outcome.[16] We have two references for 1977. Collier (1989)

[14]This number is an upper bound of the labor supply constraint. Note that the number of registered job-seekers is higher than the number of unemployed people according to the definition by the International Labor Organization, e.g., because discouraged workers are partly registered to receive unemployment benefits. However, we assume that all registered job-seekers are constrained in their labor supply despite evidence for discouraged workers due to unemployment benefits in the considered period (see Ljungqvist and Sargent, 2007).

[15]Recall that term $\omega^L_{Wt} F_{lWt}$ equals FRG's marginal rate of substitution of unconstrained allocations of consumption and leisure.

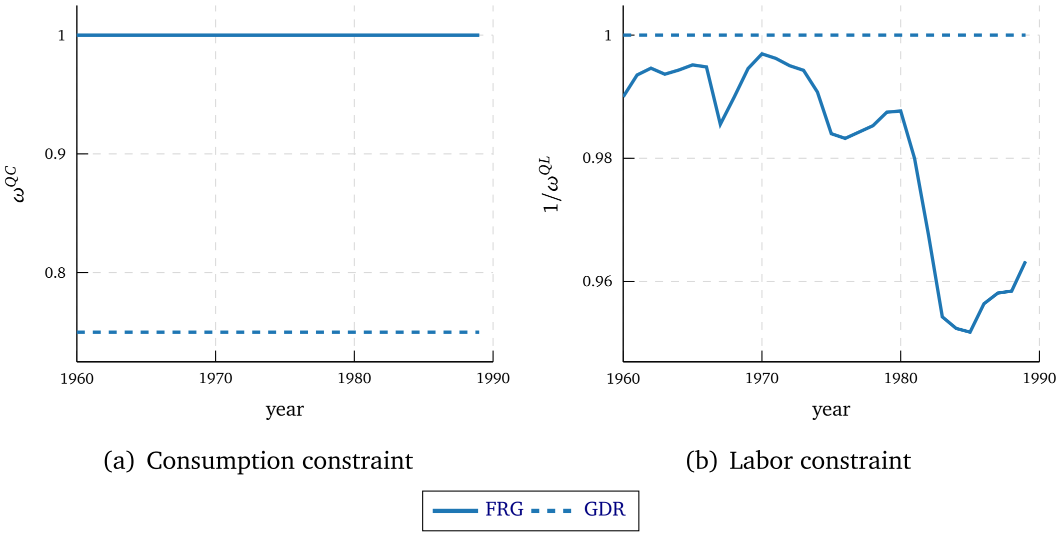
[16]Instead of the indifference curve, we could go along the budget constraint. However, we would compare marginal utility at an infeasible consumption composition. Thus, we refer to a feasible utility level. Note

calculates expenditure functions at GDR households utility levels for relative GDR prices and FRG prices, i.e., market clearing prices. He finds that a GDR household would give up 11 % of its income to avoid quantity constraints by having FRG prices in 1977. Collier (1986) calculates 13 % to avoid quantity constraints subject to GDR relative prices. Further, we can use the distant function of the GDR consumption bundle for the FRG household utility level in 1977 of Collier (1989) to calculate that a FRG household must be compensated by 62 % of its income to accept a multiple of the GDR consumption bundle. Given our utility parameterization, all three measures provide the ratio of the marginal utility of aggregate consumption expenditures to the consumption quantity constraint. The range of the former two (0.87 – 0.89) is an upper bound as it implies the consumer only wants to substitute within goods with prices in the GDR, i.e., that have positive supply, which is rejected by revealed preferences. The latter is a lower bound as the reference is a multiple of the GDR consumption bundle whose slope is lower than the optimal marginal utility of aggregated consumption in the presence of superior and inferior goods. Due to the ambiguity, we take the mean, $\omega^{QC}_{E1977} = 0.75$. Collier (2012) finds values in a similar order of magnitude for different household types in 1989, indicating stable quantity constraint frictions, which is why we set $\omega^{QC}_{Et} = \omega^{QC}_{E1977} = 0.75 \forall t$. Nevertheless, we discuss the effects of time-varying consumption constraints on the wedges below.

We plot the quantity constraint wedges on consumption and the reciprocal of the quantity constraint wedges on labor supply in Figure 2 (a) and (b). We present the latter as reciprocal since the effect on the labor wedge of both wedges is, in this representation, equivalent: Rising constraints on consumption demand or labor supply will lower the consumption or the reciprocal of labor quantity constraint wedges, both leading to rising labor wedges, ceteris paribus. It turns out that the unemployment wedge in the FRG evolves close to one until the 1980s, when the reciprocal of the wedge drops to 0.95. In comparison, the consumption quantity constraint is 0.75 over the whole period, with a lower bound smaller than 0.9. Achieving equality between the labor constraint wedge and the lower bound of the consumption constraint wedge necessitates a leisure preference parameter that is twice the value utilized in our benchmark calibration.

that the difference in marginal utility along the indifference curve is larger.

Figure 2: Quantity constraint wedges



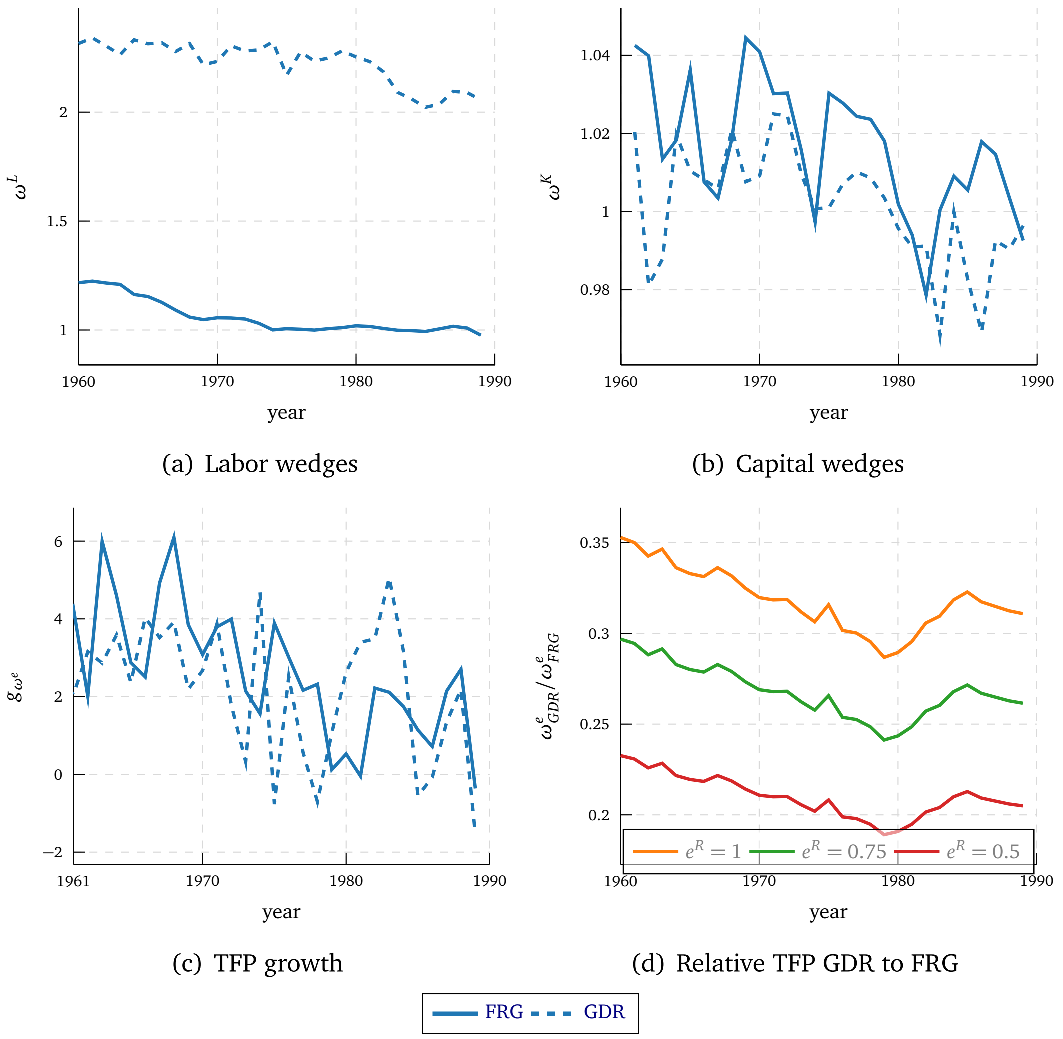
(a) Consumption constraint

(b) Labor constraint

4.3 Factor and productivity wedges

We present here the results of the factor and productivity wedges $\{\omega^e_{it},\ \omega^L_{it},\ \omega^K_{it+1}\}^T_{t=0}$. Figure 3 plots the sequences, straight for the FRG, dashed for the GDR. We omit the presentation of the residual demand and government consumption wedges $\{\omega^D_{it},\ \omega^G_{it}\}^T_{t=0}$ as they equal the residual demand- and government consumption-to-GDP measures in Figure 1.

Figure 3: Wedge accounting



(a) Labor wedges (b) Capital wedges

(c) TFP growth (d) Relative TFP GDR to FRG

Labor wedges Panel (a) displays the labor wedges. On average, the FRG's labor wedge drops largely by 0.70 % p.a. over time, while GDR's labor wedge drops only slightly by 0.43 % p.a. Consequently, the remarkable initial gap even increases over time, ending up in a twice as high labor wedge in the GDR compared to the FRG. There are minor differences in fluctuation at the business cyclical frequency.

The labor wedges depend on the chosen parametrization and calibration and, consequently, on the assumption of preference homogeneity between the two Germanies. However, for a given quantity constraint wedges, the parameter θ scales only the intercept of the log of the labor wedge. Hence, the relative distance between the regional wedges remains as long as the parameters are homogeneous. Heterogeneity in one of the parameters would change the relative distance exactly by the relative difference of the parameters. Thus, for a labor wedge parity in 1989, the value of the preference parameter for leisure (θ) in the GDR would have to be roughly half of the FRG's one. Fehrle and Konysev (2025) show a convergence of GDR's labor wedge toward FRG's one in the reunified Germany, indicating no heterogeneous leisure preferences.

In our parameterization, wealth and substitution effect for labor cancel each other out, i.e., the household's labor supply is independent of the long-run consumption growth. However, there is the concept for a decreasing aggregated labor supply with aggregated income, e.g., Bick et al. (2018) report that adults work more in low-income countries than in high-income countries. Boppart and Krusell (2020) introduce a class of balanced-growth compatible utility functions with falling labor supply with increasing productivity. An application of such preferences in the wedge-accounting framework is done by del Río and Lores (2023). The effect of such preferences would be a weaker negative trend in labor wedges. Indeed, differences in productivity could explain a part of the relative distance between the labor wedges. However, we conclude that the differences between the wedges and their decline are mainly not driven by income effects for three reasons: first, Bick et al. (2018) report the remarkable differences only for low-income countries, while the GDR is considered as a middle-income country, second, the decline in hours worked in the FRG was exceptionally high in international comparison (see Boppart and Krusell, 2020), and third, Fehrle and Konysev (2025) show convergence of the labor market wedges in the areas of the former GDR and FRG after reunification in the absence of productivity convergence and Jarosch et al. (2025) find no time trend in hours worked for full-time workers in Germany considering the period after 1985.

Regarding the effects of the quantity constraint wedges, note that both wedges act like a leisure preference shift. The upper bound of the consumption constraint wedge in the GDR would scale the labor wedge by a factor of $0.75/0.89 \approx 0.84$ and the lower bound by $0.75/0.62 \approx 1.21$. Furthermore, since the labor constraint wedge is derived conditional on the leisure preference parameter, variations in this parameter scale the FRG labor wedge, thereby affecting the relative distance between the FRG and GDR wedges. Nevertheless, given the quantitatively minor contribution of the labor constraint wedge, this effect remains negligible.

Capital wedges Panel (b) displays the trajectories of the capital wedges. FRG's capital wedge has a relatively bigger distance from the one in 1960 than GDR's capital wedge and fluctuates slightly more at the business cycle frequency in the 1960s and 1970s.[17] GDR's capital wedge declines less than FRG's capital wedge on average during the considered period (−0.11 % p.a. versus −0.12 % p.a.). Consequently, FRG's capital wedge converges to the capital wedge of the GDR.

Our functional form of utility implies a homogeneous elasticity of intertemporal substitution equal to one. While this is not an unusual value, another frequently used value is 0.5. Such a value would enhance the effects of intertemporal consumption differences on the capital wedge, i.e., the wedge's fluctuations would increase while the effect on the intercept depends on the value of the intertemporal marginal rate of substitution of consumption. The effect of the discount factor β on the capital wedge is equivalent to $1/\theta$ on the labor wedge—β scales the intercept of the log of the capital wedge. Following the analysis of how θ influences the labor wedge, we can examine how variations in the discount factor β affect the capital wedge.

As we choose a constant consumption quantity constraint wedge, the intertemporal effect on the capital wedge cancels out. However, the effect of a non-constant wedge is readily comprehensible after discussing the time preferences β on the capital wedge as changes in the consumption constraint wedge act like a time preference shift. An increasing rationing of consumption goods would increase the capital wedge and, vice versa, a decreasing rationing would decrease the capital wedge for a given t.

Productivity wedges Panel (c) reports the growth rates of TFP. The growth rates decrease over time. At the business cycle frequency, they often move in opposite directions and with different-sized spikes. Only from the early- until the mid-1980s, the GDR experienced a persistent phase of higher TFP growth rates than the FRG. But the average growth rate in the FRG of 2.70 % is higher than the average TFP growth rate in the GDR (2.26 %). The higher rate becomes especially apparent in Panel (d). There, we plot the ratio of GDR's TFP to FRG's TFP. We use three different purchasing power parity exchange rates to cover a broad spectrum from the literature ($e^R \in \{1,\ 0.75,\ 0.5\}$). Note that TFP is measured in prices from 1989 and local currency, both with the power of the output elasticity of labor of the corresponding country. Thus, we use the same exponent for the exchange rate $e^{R\,(1-\alpha_E)}$ to convert the TFP of the GDR. The panel illustrates again that the average growth rate of TFP in the FRG is higher, since the initial TFP ratio is higher than

[17] Mind that the data for some years for the GDR in the 1970s are interpolated. Thus, no statements on the business cycle frequency are valid in this period.

the one in 1989. The GDR falls back until the early 1980s when a remarkable catch-up is visible. However, over the period considered, the GDR falls slightly by approximately 5 percentage points. A slight fallback is poor given an initial TFP level between a third and a quarter of FRG's TFP.

5 COUNTERFACTUAL ANALYSIS

Here, we conduct counterfactual experiments to assess the role of the wedges on economic outcomes. For this purpose, we construct a dynamic general equilibrium model using our theoretical framework, i.e., the production technology, the capital law-of-motion, and, as equilibrium conditions, the wedges (6a) – (6e). Within this framework, we can change discretely the values of the wedges and evaluate the impact on the model outcome.

Since we have a divided nation and two contrasting economic systems, it seems natural to use the wedges or wedges' growth rates of the respective economy's counterpart to conduct counterfactuals. Such counterfactuals give us the answer to the question: how much do the differences in allocative and productive efficiency between the two Germanies matter in terms of economic activity and welfare within the model? [18]

5.1 Computational implementation

The parameterized nonlinear equation system for $t = 0, 1 \ldots T, T+1 \ldots \infty$, expressed in per-capita terms,

$$\frac{\theta_i(c_{it} + g_{it})}{\bar{l} - l_{it}} \frac{\omega_{it}^{QC}}{\omega_{it}^{QL}} = \omega_{it}^{L}(1 - \alpha_i)\frac{y_{it}}{l_{it}}, \tag{7a}$$

$$\frac{c_{it+1} + g_{it+1}}{c_{it} + g_{it}} \frac{\omega_{it}^{QC}}{\omega_{it+1}^{QC}} = \beta_i \omega_{it+1}^{K}\left(1 - \delta_{it+1} + \alpha_i \frac{y_{it+1}}{k_{it+1}}\right), \tag{7b}$$

$$y_{it} = \omega_{it}^{e} k_{it}^{\alpha_i}(h(s_{it})l_{it})^{1-\alpha_i}, \tag{7c}$$

$$g_{Nit+1}k_{it+1} = (1 - \delta_{it})k_{it} + i_{it}, \tag{7d}$$

$$(1 - \omega_{it}^{D})y_{it} = c_{it} + g_{it} + i_{it}, \tag{7e}$$

$$g_{it} = \omega_{it}^{G} y_{it}, \tag{7f}$$

[18] An alternative approach to interpreting the unitless wedges is to quantify the associated deadweight loss using Harberger's triangles. However, this method captures only static, partial equilibrium effects, whereas our framework incorporates dynamic general equilibrium considerations.

represents our model economies and governs the dynamics of 12 endogenous variables

$$\{y_{it}, c_{it}, i_{it}, l_{it}, g_{it}, k_{it+1}\}_{t=0}^{\infty}, \tag{8}$$

given the set of 20 exogenous variables and time-varying parameters

$$\{\omega_{it}^{QL}, \omega_{it}^{QC}, \omega_{it}^{L}, \omega_{it+1}^{K}, \omega_{it}^{D}, \omega_{it}^{G}, \omega_{ijt}^{e}, s_{ijt}, g_{Nit+1}, \delta_{it}\}_{t=0}^{\infty}, \tag{9}$$

the set of calibrated parameters, the initial capital stocks k_{i0}, and the transversality conditions $\lim_{t\to\infty} \beta_i^t \frac{k_{it+1}}{g_{it}+c_{it}} = 0$. Solving the model represented by this system for the endogenous variables is a two-point boundary value problem. The initial condition k_{i0} is observable, but the terminal condition must be inferred, as the post-T trajectory is never realized, yet, under perfect foresight, agents' decisions for $t = 0, \ldots, T$ are subject to the anticipated path after T. We address this problem using the method proposed by del Río and Lores (2021) and leave further details to the Appendix B: i) We calibrate a sufficient number of steady-state values to determine a fixed point, from which all steady-state values of endogenous and exogenous variables follow. This steady state serves as terminal condition. ii) We simulate a convergence path for the set of observables toward this fixed point and determine the remaining variables using system (7). We can then solve the system from the observed initial condition to the fixed point with actual and counterfactual paths of the wedges. Counterfactual trajectories of the wedges shift the terminal condition by altering the fixed point, while the initial condition remains unchanged (see also Fehrle and Konysev, 2025).

Steady states and steady-state targets To pin down the steady state values of the models' variables, we match long-term observed data from both German economies. In particular, we set the long-run private consumption-to-GDP ratios $\frac{c_i}{y_i}$, investment-to-GDP ratios $\frac{i_i}{y_i}$, government consumption-to-GDP ratios $\frac{g_i}{y_i}$, levels of hours l, levels of average years of schooling s_i, and the levels of GDP y_i to their empirical average counterparts in 1980 – 1989. Likewise, the long-run values of the parameters $\{\delta, g_{Ni}\}$ and wedges $\{\omega_i^{QC}, \omega_i^{QL}\}$ correspond to the averages of the exogenous depreciation rates, population growth factors, and quantity constraint wedges from the years 1980 – 1989.

Table 2: Summary of long run-targets

Variable	Value/Target		Description
	GDR	FRG	
$\frac{c}{y}$	0.545	0.557	Private consumption-to-GDP Ratio
$\frac{i}{y}$	0.284	0.202	Investment-to-GDP Ratio
$\frac{g}{y}$	0.214	0.203	Government consumption-to-GDP Ratio
l	996.23	761.53	Worked hours per capita
h	3.71	3.13	Human capital per capita
s	9.78	8.58	Average years of schooling
y	17459	34180	Real GDP per capita
g_n	0.999	1.002	Population growth factor
δ	0.0278	0.0276	Capital depreciation rate
ω^{QC}	0.750	1.000	Consumption quantity constraint wedge
ω^{QL}	1.000	1.042	Labor quantity constraint wedge

Notes: Level magnitudes y_i is valued by constant local prices: By the domestic currency Ostmark (DDM) in 1989 in the GDR and by the Deutsche Mark (DEM) in 1989 in the FRG.

Given the target values for the structural parameters $\{\beta_i, \ \theta_i, \ \bar{l}, \ \alpha_i, \ \gamma_1, \ \gamma_2, \ \gamma_3\}$ and the fixed point of the equation system (7) summarized in Table 2, we obtain the steady state of the variables $\{k_i, \ c_i, \ i_i, \ r_i, \ w_i\}$ and wedges $\{\omega_i^e, \ \omega_i^L, \ \omega_i^K, \ \omega_i^D\}$ listed in the Table A.1. The latter gives us an indication of the long-term relative inefficiencies in the allocations of the two Germanies. The computation steps are as follows: 1) Given the long-run GDP level y_i, we compute the stationary expenditure-side levels $\{c_i, i_i, g_i\}$ directly from their respective target ratios. 2) Given $\frac{c_i}{y_i}$, $\frac{i_i}{y_i}$ and $\frac{g_i}{y_i}$, the resource constraint (7e) leads to the long-run residual demand ω_i^D. 3) Also, with a given investment-to-GDP ratio, we can determine the capital-output ratio $\frac{k_i}{y_i}$ from the fix point of the capital law of motion (7d). Again, given y_i, the level of capital k_i follows with $\frac{k_i}{y_i}$. 4) The long-run capital wedge ω_i^K is derived from the stationary Euler equation (7b), as we specifically set the discount rate β_i. 5) Similarly, with a given leisure weight θ_i, we endogenously determine the long-run labor market wedge ω_i^L from the long-run consumption-leisure decision (7a). 6) All production input and output levels determine combined with the capital share α_i over the production function (7c) the long-run productivity wedge ω_i^e. 7) Finally, we deduce the long-run values of the marginal productivity conditions for capital and labor input in the production—$\alpha_i \frac{k_i}{y_i}$ and $(1-\alpha_i)\frac{k_i}{l_i}$.

5.2 Results

Figure 4 reports our counterfactual analysis for the GDR. Specifically, we substitute the TFP growth rates and the capital and labor wedges of the FRG one by one into GDR's model economy. Additionally, we make a zero residual demand wedge and a no productivity growth counterfactual analysis. Formally, the dashed lines in the three panels correspond to the (normalized) trajectories of the endogenous variables assuming the counterfactual wedges' paths $\bar{\omega}^{j}_{Et}, j \in D, e, K, L$:

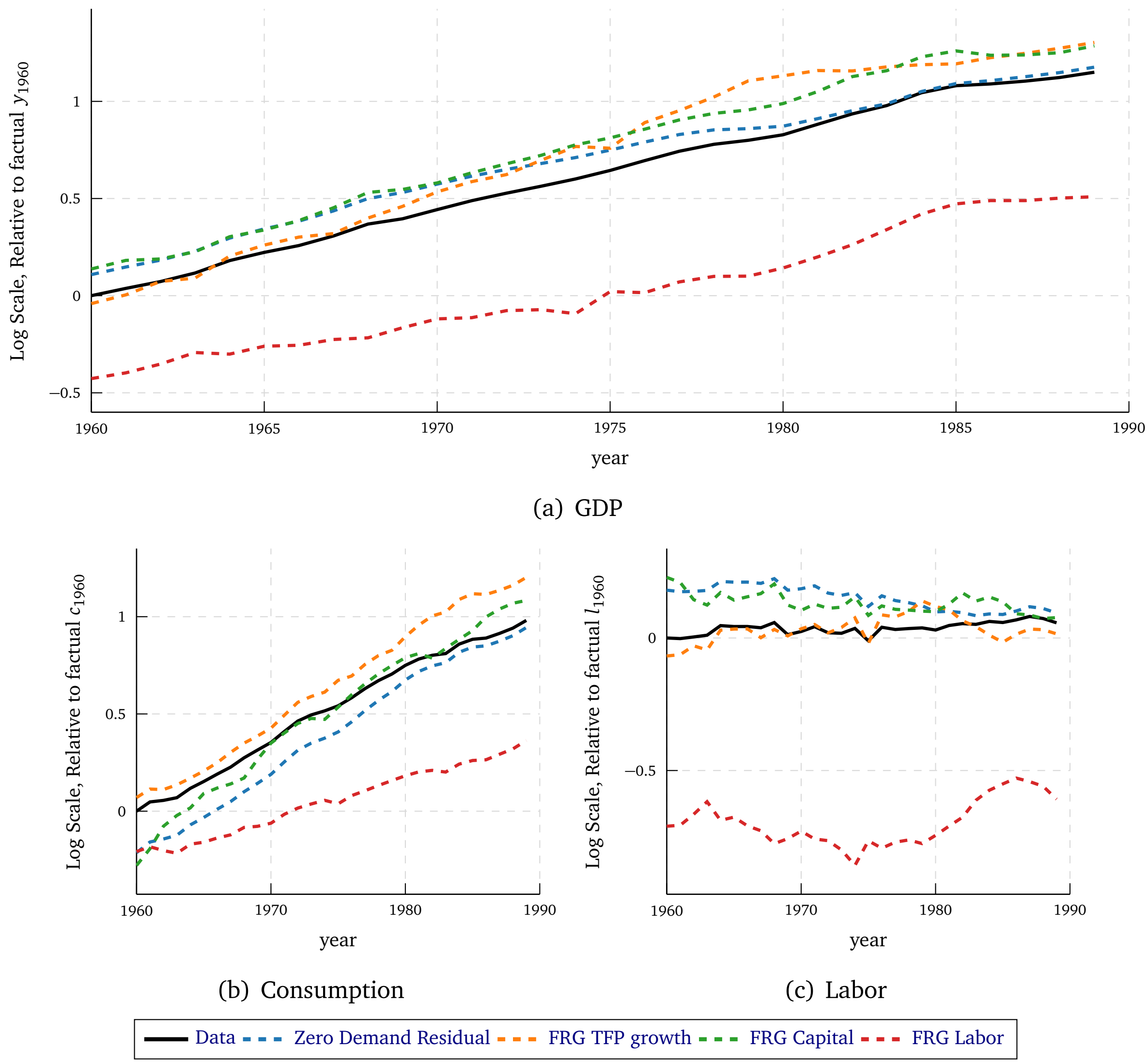
- Zero residual demand: $\bar{\omega}^{D}_{Et} = 0$, $\forall t$ (dashed blue),
- TFP growth from FRG: $\bar{\omega}^{e}_{Et+1} = \frac{\omega^{e}_{Wt+1}}{\omega^{e}_{Wt}} \bar{\omega}^{e}_{Et}$, $\forall t$ and $\bar{\omega}^{e}_{E1960} = \omega^{e}_{E1960}$ (dashed orange),
- Capital wedges from FRG: $\bar{\omega}^{K}_{Et} = \omega^{K}_{Wt}$, $\forall t$ (dashed green),
- Labor wedges from FRG: $\bar{\omega}^{L}_{Et} = \omega^{L}_{Wt}$, $\forall t$ (dashed red),

and the black lines display the (normalized) data counterparts of those endogenous variables. As the vice versa exercise for the FRG approximately mirrors largely the results of this exercise, despite present non-linearities, we put them in Appendix C.

Panel (a) assesses the impact of the wedges by reference to economic activity (real GDP per capita). Economic activity would be around 3–5 years ahead with zero residual demand from 1960–1980. From 1980 on, the impact of residual demand was minor, as residual demand decreased to near zero. The counterfactual economic activity in the GDR with the capital wedge from the FRG evolves similarly to the zero net inflows counterfactual in the first half of the period. However, economic activity would be around 5 years ahead over the whole period. Economic activity would prosper more with TFP growth observed in the FRG. Especially from the end of the 1960s, FRG's TFP growth promotes GDR's economic activity. Remarkably, this counterfactual economic activity already has the same value around 1980 as the observed one at its peak at the advent of the reunification. The FRG's labor wedge depresses economic activity up to a decade of economic prosperity. General changes in the business cycle frequency are invisible to the eye. Lastly, note that the counterfactuals for residual demand (except in the zero residual demand counterfactual) and government consumption relatively equal the counterfactuals of GDP as they are fractions of GDP.

Panel (b) and panel (c) address the effects of the remaining counterfactual wedges for welfare augmenting quantities—private consumption and leisure. Regarding consump-

Figure 4: Counterfactual outcomes in the GDR



(a) GDP

(b) Consumption

(c) Labor

tion, equalizing with FRG's TFP growth would steadily increase GDR's per capita consumption. This increase sums up to a hypothetical surplus of more than 25 % on the eve of reunification. The effect of the FRG's capital wedge on GDR's consumption is minor in the 1970s. However, FRG's capital wedge depresses consumption largely in the early 1960s (to around 80 % of the data) and lifts consumption by approximately 10 % in the late 1980s. Zero residual demand and the FRG's labor wedge depress consumption over the whole period. While the zero residual demand counterfactual depresses consumption, particularly at the beginning of the period, the FRG's labor wedge at the end.

Concerning the effects on hours worked, we observe first in panel (c) that FRG's labor wedge counterfactual increases leisure remarkably. The zero residual demand and the capital wedge would increase hours worked, especially at the beginning of the period considered (around 20 %). Further, the effect of the zero residual demand is larger most of the time. The effect of TFP growth is, on average, small as there is no income effect in utility.

Panels (a) and (b) reveal a crucial insight: the GDR's GDP growth advantage was not driven by total factor productivity (TFP) or capital accumulation. Rather, it reflects a comparatively elevated labor input, a consequence of the growing labor wedge differential and the decreasing difference in the residual wedge, which attenuated the income effect on leisure.

As noted in our calibration section, a valuable byproduct of using the wedges from the other Germany as counterfactuals is that the resulting model-implied quantities are independent of the specific value of the preference parameter. This independence arises precisely because of the underlying indeterminacy between preference parameters and average factor wedges. Consequently, our results for output, consumption, and labor under the chosen counterfactual labor and capital wedges and TFP growth rates are super-robust. Hence, the only channel through which these parameters exert influence is via adjustments to the labor quantity constraint wedge and the zero-residual counterfactual. However, as concluded earlier, the effect on the former is negligible. We will address the latter in the robustness section of our welfare analysis, where the choice of preference parameters generally plays a more significant role.

Welfare analysis As some counterfactuals indicate opposing effects on consumption and leisure, the overall effect on utility and welfare is ambiguous. To assess the effect on welfare due to the wedge differences entirely, we calculate two consumption equivalent welfare gain measures $\Delta^k, k \in \{1,2\}$. The measures are the solutions of

$$\sum_{s=0}^{\infty} \beta_i^s N_{it+s} u(c_{it+s}, g_{it+s}, l_{it+s}, \omega_{it}^{QC}, \Delta^1) \stackrel{!}{=} \sum_{s=0}^{\infty} \beta_i^s N_{it+s} u(c_{it+s}^c, g_{it+s}^c, l_{it+s}^c, \omega_{it}^{QC}), \tag{10a}$$

$$\sum_{s=0}^{T} \beta_i^s N_{it+s} u(c_{it+s}, g_{it+s}, l_{it+s}, \omega_{it}^{QC}, \Delta^2) \stackrel{!}{=} \sum_{s=0}^{T} \beta_i^s N_{it+s} u(c_{it+s}^c, g_{it+s}^c, l_{it+s}^c, \omega_{it}^{QC}), \tag{10b}$$

where the superscripts c denote the counterfactual and no superscripts the observed time series, and per-period utilities read

$$u(c_i, g_{it}, l_{it}, \omega_{it}^{QC}, \Delta^k) = \omega_{it}^{QC} \ln\big((c_{it} + g_{it})(1+\Delta^k)\big) + \theta_i \ln(\bar{l} - l_{it}),$$
$$u(c_{it}^c, g_{it}^c, l_{it}^c, \omega_{it}^{QC}) = \omega_{it}^{QC} \ln\big((c_{it}^c + g_{it}^c)\big) + \theta_i \ln(\bar{l} - l_{it}^c).$$

We account for the different marginal utilities of the consumption bundles via ω_{it}^{QC}. The consumption-equivalent welfares Δ^k quantify how much percentage points of the observed consumption paths households in $i = \text{E}$ at the initial time $t = 1960$ are prepared to give up or to be compensated for if it faces the consumption and leisure paths coming from a counterfactual policy ^{c}. Therefore, positive consumption-equivalent welfare indicates a gain and vice versa. Starting from $t = 1960$, Δ^1 measures the discounted consumption bundle equivalent differences of the total population until infinity.[19] However, data on the GDR is missing from 1989 onward, and consequently, wedges are computed by additional assumptions.[20] Therefore, Δ^2 captures only the observable periods with $T = 30$, i.e., until 1989.

Table 3 lists the different welfare measures for the previously calculated counterfactual time series. Additionally, to the described counterfactuals, we add no TFP growth ($\bar{\omega}_{Et}^e = \omega_{E1960}^e, \forall t$). This serves as a benchmark of comparison for the TFP growth from the FRG counterfactual. When considering the impact on welfare measures over an infinite period (Δ^1), the scenario of zero residual demand shows a moderate negative effect, indicating a reduction in consumption-equivalent welfare. The no-TFP growth scenario indicates an even stronger negative impact on consumption-equivalent welfare. TFP growth from FRG demonstrates a substantial positive impact, suggesting that advancements in TFP significantly enhance consumption-equivalent welfare over the long term. The welfare effects of FRG's TFP growth counterfactual are more than half of the value of the negative

[19] Actually, we cut after 1029 years, missing $< 10^{-8}$ % of $\sum_{t=0}^{\infty} \beta_E^t$.

[20] See Appendix B.2.

Table 3: Consumption equivalent welfare measures for GDR

Counterfactual	Welfare measure in %	
	Δ^1	Δ^2
Zero residual demand	-14.79	-23.88
No TFP growth	-38.58	-25.02
TFP growth from FRG	34.60	13.33
Capital wedge from FRG	-0.62	-13.87
Labor wedge from FRG	22.03	37.91

Notes: Δ^1 captures discounted total consumption equivalence until infinity (equation (10a)), Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)).

effect in the no TFP growth counterfactual. The influence of the capital wedge from the FRG is, in comparison, minor. The FRG's labor wedge raises consumption-equivalent welfare by nearly 26 %. However, mind that our calibration exercises imply zero distortion on average in the FRG during 1975 – 1989, making this result an upper bound.

Over the period under consideration (Δ^2), the scenario of zero residual demand exhibits a more pronounced negative impact by approximately -25 % of consumption-equivalent welfare compared to the infinite timeframe. Conversely, FRG's TFP growth continues to have a positive effect. Albeit with 13 % less substantial than in the long term, though still nearly half of the value of the negative effect of the no TFP growth counterfactual. FRG's capital wedge results in a notable negative impact on welfare by -15 % during the considered period. Meanwhile, FRG's labor wedge counterfactual shows the largest positive impact on consumption-equivalent welfare of 39 %—again representing an upper bound.

In contrast to the counterfactual quantities, the welfare measure naturally depends on the values of the unidentified preference parameters. We examine the sensitivity of our results to these parameter choices in the following robustness section.

6 Sensitivity analysis and discussion

6.1 Robustness checks

To verify the robustness of our findings, we conduct various exercises. We provide a brief overview in this section and reserve more details for Appendix D.

We begin by assessing the influence of the preference parameter values on our welfare measure, evaluating welfare outcomes across a broad range of parameter values. Further, we consider a per-capita welfare measure and welfare measures without time discounting to assess the impact of a different valuation of the future and population by the social planner. We evaluate the impact of our human capital productivity parameterization by calculating Solow residuals, which do not account for human capital, at all. Similarly, we evaluate the impact of the quantity constraint wedges by considering counterfactuals with $\bar{\omega}_{it}^{QC} = \bar{\omega}_{it}^{QL} = 1 \ \forall i, t$ and conducting the full exercise where we ignore binding quantity constraints. Note that the latter is the standard regarding unemployment. Further, we compare our findings with the results from the antipode of the assumption of perfect substitutability of government and private consumption: government consumption as pure waste. Lastly, we conduct our exercise with the net capital stock to confront our findings with another commonly used capital measure, the net capital stock.

Parameter sensitivity Figure 5 presents our welfare measure, Δ_2, across a broad range of preference parameter values—Panel (a) varies the leisure preference, and Panel (b) the time preference. Except for the welfare outcome under the FRG labor wedge counterfactual, which is sensitive to the leisure preference parameter, our results exhibit strong robustness. Moreover, the FRG labor wedge counterfactual only ceases to affect welfare positively within the parameter range < 3.5 typically associated with the working-age population (ages 15–65) preference in the macroeconomic literature.[21] Thus, although the welfare implications of the labor wedge are parameter-sensitive, our qualitative findings remain valid for empirically plausible parameter values.

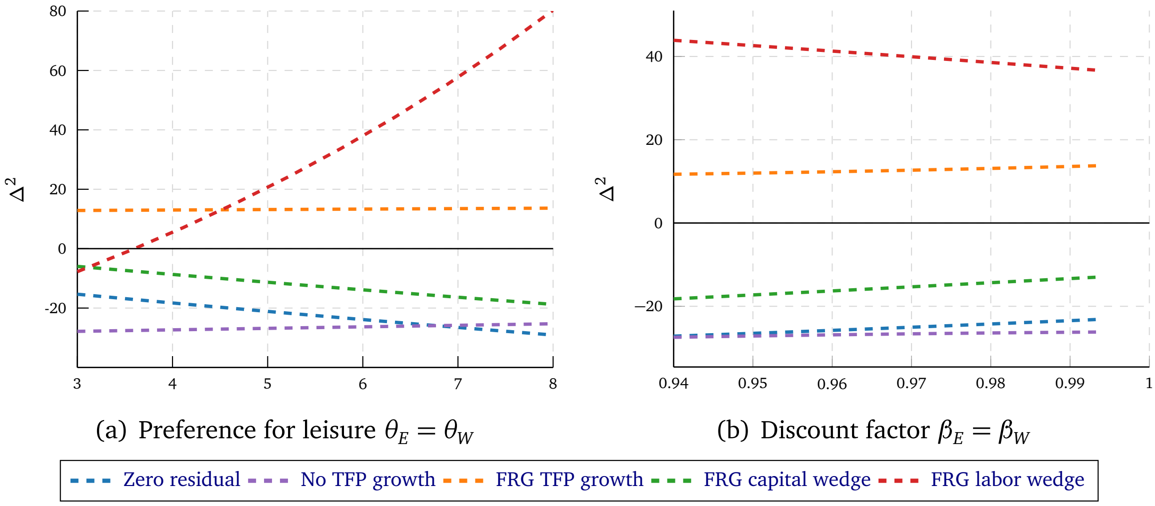
[21] We consider the whole population as we consider the working age as endogenous between the two systems.

Table 4: Consumption equivalent welfare measures for GDR

Counterfactual	Welfare measure in %			
	Δ^2	Δ^3	Δ^4	Δ^5
Zero residual demand	-23.88	-23.77	-22.63	-22.52
No TFP growth	-25.02	-25.01	-24.86	-24.86
TFP growth from FRG	13.33	13.38	14.09	14.16
Capital wedge from FRG	-13.87	-13.75	-12.35	-12.23
Labor wedge from FRG	37.91	37.73	35.79	35.61

Notes: Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)), Δ^3 captures discounted per capita consumption equivalence for the considered period ($N_{it} = 1,\ \forall t, i$), and Δ^4 captures non-discounted total consumption equivalence for the considered period ($\beta = 1 \forall i$), Δ^5 captures non-discounted per capita consumption equivalence for the considered period ($\beta_i = 1 = N_{it} = 1,\ \forall t, i$).

Figure 5: Welfare measures for GDR - parameter sensitivity

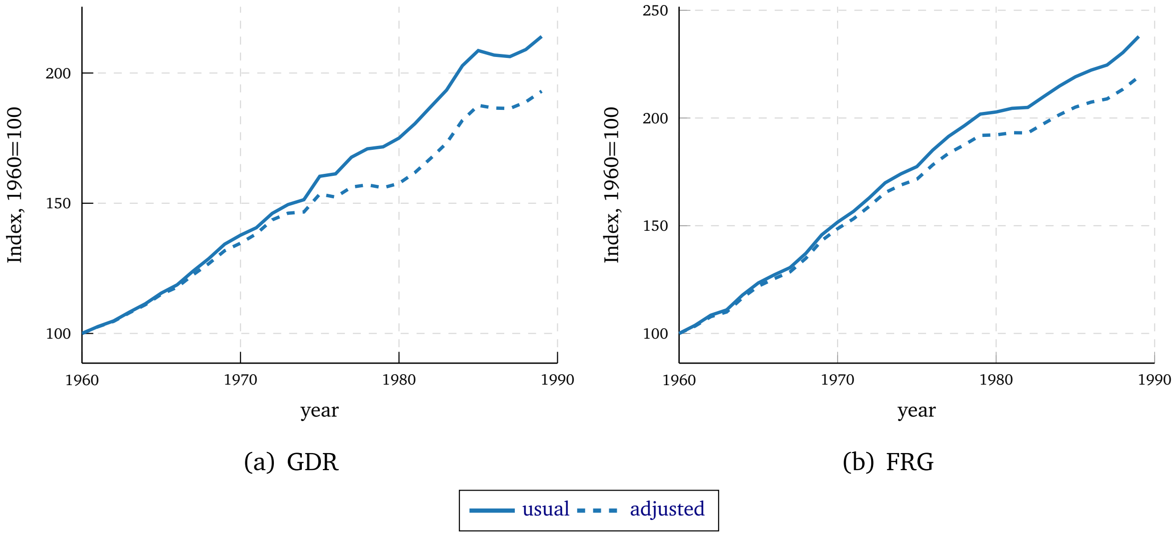


(a) Preference for leisure $\theta_E = \theta_W$

(b) Discount factor $\beta_E = \beta_W$

Alternative welfare Table 4 reports the additional welfare measures. Our per-capita welfare measure (Δ^3) follows Formula (10b) with $N_{it} = 1,\ \forall t, i$. Similarly, the no-discounting welfare measure (Δ^4) from Formula (10b) with $\beta_i = 1 \forall i$ and the per-capita no-discount measure (Δ^5) assumes jointly $\beta_i = 1 = N_{it} = 1,\ \forall t, i$. While the impact of FRG's TFP growth counterfactual on welfare increases, all other counterfactuals' impact decreases. However, as the values change only up to 3 percentage points, the qualitative statement does not change.

Figure 6: Comparison of TFP measures



(a) GDR (b) FRG

Solow residuals To check for the robustness of our human capital productivity specification, we compare our human capital-adjusted TFP measure

$$\omega_{it}^{e} = \frac{y_{it}}{k_{it}^{\alpha_i}(h_{it}l_{it})^{1-\alpha_i}} \tag{11a}$$

with the usual measure (Solow residuals). Assuming the standard Cobb-Douglas production function without the adjustment for labor quality, $y_{it} = \omega_{it}^{E} k_{it}^{\alpha_i} l_{it}^{1-\alpha_i}$, we derive our measure of usual TFP, Solow residuals, by

$$\omega_{it}^{E} = \frac{y_{it}}{k_{it}^{\alpha_i}(l_{it})^{1-\alpha_i}}. \tag{11b}$$

Given the measured sequences for ω_{it}^{e}, h_{it} and the parameter α_i, Solow residuals follows from

$$\omega_{it}^{E} = \omega_{it}^{e} h_{it}^{1-\alpha_i}. \tag{11c}$$

Figure 6 illustrates the impact of human capital accumulation on TFP growth. Over the whole period considered, usual (adjusted) TFP grows by 2.7 % (2.3 %) on average in the GDR and by 3.0 % (2.7 %) in the FRG. Hence, TFP grows faster in both regions when human capital is not considered extra. This effect on the average TFP growth is 0.1

percentage point stronger in GDR than in FRG due to the hefty increase of the average years of schooling in the GDR from the early-1970s. We run our wedge-accounting analysis as well with the usual TFP measures from Formula (11b) in Appendix D.1. The consumption equivalent welfare measures for the GDR from the two TFP growth-related counterfactuals shrink by a few percentage points.

Quantity constraints For a better understanding of the quantity constraint wedges, we first illustrate in Figures A.3 and A.4 in Appendix D.2 the counterfactuals for the GDR and the FRG, where we set the respective constraint wedge equal one. The effect is equivalent to an increasing labor wedge. The quantities result solely from the allocation based on the wedges in Figure 3. However, note that in the GDR, marginal utility increases additionally by a third in the GDR.

Second, we ignore quantity constraints at all, i.e., assuming $\omega_{it}^{QC} = \omega_{it}^{QL} = 1 \forall i, t$, before conducting the whole wedge-growth accounting analysis. We put the analysis in Appendix D.2, too. First, both labor wedges change by the factor of the plotted time paths in Figure 2. In this specification the negative effect on Δ^2 (welfare only in the observable period) of the zero residual demand slightly decreases close to -20 %, the positive effect of TFP growth from the FRG remains almost unchanged at 13 %, the negative effect from FRG's capital wedge slightly decreases to -11 % and the positive effect from FRG's labor wedge strongly decreases below 14 %. We observe the same patterns in the long-run view (Δ^1).

Government consumption Appendix D.3 reproduces the entire wedge-growth accounting exercise using a per-period utility function $u = \ln(c) + \theta_i \ln(\bar{l} - l)$ instead of $u = \ln(c + g) + \theta_i \ln(\bar{l} - l)$.

As shown in Figure A.9, given the negative wealth effect on GDR's economy caused by the zero residual demand counterfactual, the level of government consumption increases stronger in the model without g in utility than in the model with g. Private consumption c and leisure $\bar{l} - l$ decrease stronger in the model with g in utility. Thus, in the zero residual demand counterfactual, consumption equivalent welfare is higher in absolute terms without g in utility, as it only refers to changes in private consumption. The consumption equivalent welfare measures for the TFP related counterfactuals remain nearly unchanged. Concerning the labor and capital wedge counterfactuals, absolute welfare measures rise by 3 to 6 % points.

Net capital stock Appendix D.4 reproduces the entire wedge-growth accounting exercise using net capital stock data. First, regarding the depreciation rates: they are in the range of 3.5–5.5 % and the capital stock to GDP ratios between 2 and 3.5. The capital wedges shift down, the FRG's fluctuates around one, and the GDR's capital wedge between 0.9 and 1, indicating a slight underinvestment. TFP growth difference is larger compared to the gross fixed capital exercise. The effects on the welfare are as follows: The consumption equivalent from FRG's capital wedge counterfactual halves during the period considered and becomes even positive in the infinite view. The zero residual demand, FRG's TFP growth and labor wedge counterfactuals are in the range of 14–24% in comparison to 15–27% from Table 3 in absolute terms for the period considered. Still, only the zero residual demand counterfactual has a negative sign. In the long run, welfare from the zero residual demand and FRG's labor wedge counterfactuals get closer to zero, while, in the FRG, TFP growth counterfactual the welfare doubles. To put it briefly, using net instead of gross fixed assets as a measure of capital input leads to partly sizable changes in the welfare measures of the considered period without changing our main conclusions.

6.2 Discussion

To summarize, TFP endowment in 1960 was advantageous in the FRG, and this advantage grew over time. The counterfactual analyses reveal significant positive welfare effects for the GDR with FRG's labor allocation and TFP development. The resulting beneficial welfare becomes even greater for the FRG with GDR's wedges due to FRG's superior consumption bundle (see Appendix C, esp. Table A.2), where the frictions due to unemployment are relatively small. While the capital allocation was initially favorable for the GDR, the counterfactual with FRG's capital misallocation indicates higher welfare in the FRG from 1985 onward by higher consumption and a similar amount of hours worked.

In terms of welfare, there is evidence that GDR's policy focused on consumption over leisure. The observed higher welfare per-period in the capital counterfactual in the late 1980s and the high net inflows in the 1960s and 1970s indicate a present bias in GDR's plan. Similarly, the lower marginal utility from the GDR consumption bundle (c.p.) reflects a bias of the State Planning Commission of the GDR towards goods with already high saturation. To sum up: excessive labor in the GDR contributed to producing consumption goods with low demand due to saturation. Additionally, in our framework, increases in human capital are assumed to be costless, whereas in reality, extending years of schooling typically entails a reduction in leisure. This amplifies the degree of misallocation between leisure and consumption in the GDR relative to the FRG.

Regarding economic performance, the persistent or even increasing lower productivity in the GDR implies that catching up in GDP would be challenging despite faster GDP growth in the considered period. Especially considering that working hours in the FRG stabilized in the 1980s and the increase of GDR's human capital did not compensate for GDR's disadvantage in technology growth. Given the long-run differences, it's hard to discuss business cycles—fluctuation differences are scarcely worth mentioning.

We show the robustness of our findings over a broad range of preference parameter values. Further, neither the discounting, the population weight of the welfare measure, nor accounting for human capital changes our conclusions. The results remain qualitatively, ignoring quantity constraints and perfect substitution between private and government consumption. The net capital stock exercise even emphasizes the present bias of the GDR policy.

GDR bonds and monetary policy In the GDR, a uniform interest rate regime was in place after 1970, with a nominal rate set at 3.25 %. Before this, a short-term interest rate of 3 % applied. These rates were mainly administered through local savings banks, which collected household deposits and transferred them to the central bank. These centrally pooled savings were used to finance capital investments and government expenditures. As a result, this single administered interest rate effectively functioned simultaneously as the consumer deposit rate, the central bank deposit rate in a floor system, and the implicit bond rate.

Using this information, we can calculate a monetary or bond wedge (Šustek, 2011) via

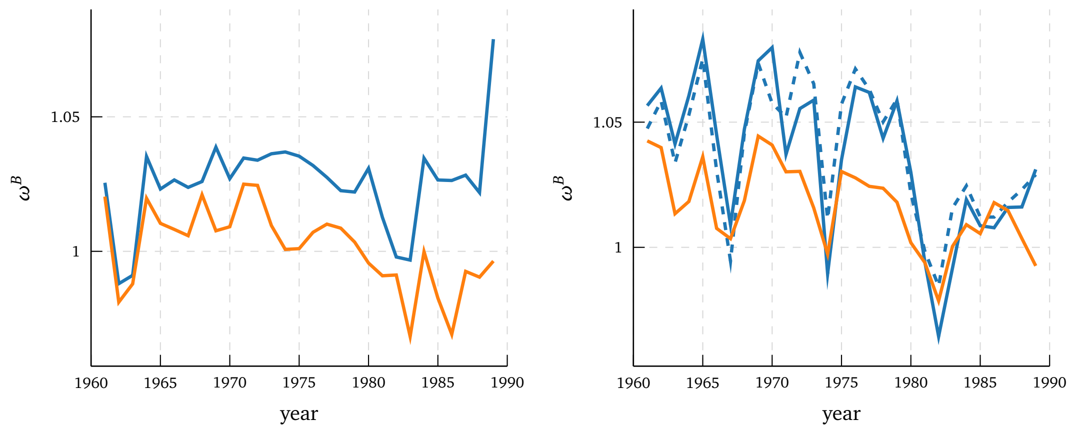
$$\omega^B_{it+1} = \frac{u_{c_{it}}/(\beta u_{c_{it+1}})}{(1+i_{it})/(1+\pi_{it+1})}, \tag{12}$$

where i_{it} is the interest rate and π_{it+1} the inflation rate measured at consumption prices.

Figure 7, Panel (a), plots the bond wedge against the capital wedge in the GDR, while Panel (b) shows the corresponding relationship for the FRG. In both cases, the bond wedge generally exceeds the capital wedge, indicating that the return on investment is higher than the real return households receive on savings in the money market. In a market economy such as the FRG, this pattern is expected due to factors we abstract from in the model—namely, liquidity and risk premia. However, in the GDR, where households were excluded from direct participation in capital markets, it is debatable whether this should apply there, too. Either way, given the GDR's persistent excess absorption, narrowing the gap between the administered deposit rate and the return on investment—by increasing the former—would have incentivized higher household savings. In turn, these increased savings mitigate the adverse effects of the excessive allocation of funds to household.

One interpretation of this analysis is that the GDR operated with an interest rate below its natural rate of interest (r^*), consistent with a comparatively stronger present bias in the GDR's central planning. Combined with rigid, near-fixed, prices, this offers an additional explanation for the existence of persistent excess absorption and aggregated quantity constraints.

Figure 7: Bond wedges



(a) GDR intertemporal wedges (b) FRG intertemporal wedges

ω^B (CB deposit rate) ω^B (Consumer deposit rate) ω^K

7 Conclusion

There is limited understanding of the comparative economic performance of the two German states formed after World War II due to valuation challenges and a lack of structural analyses. This study provides insights into the comparative development of socialist and capitalist Germany from 1960 to 1989. We achieve this by compiling an extended national accounts data set in local prices and currencies and analyzing it with unitless measures—so-called wedges. The wedges' derivation from a structural model and their unitlessness enable us to interpret and compare them across regions and time, independent of the nomination of the underlying data. Taken together, we avoid issues caused by the lack of information on PPP conversion rates. Further, we feed back counterfactual wedges to assess their impact on economic activity and welfare, i.e., real GDP, consumption, labor, and utility.

We find that despite an already substantial initial productivity disadvantage of the GDR compared to the FRG, the GDR fell further behind. The additional worsening equals a lost decade of GDP growth spread over 30 years, or more than 10 % of consumption (private and governmental). This is not obvious in a descriptive analysis, as GDP per capita in the GDR grew faster than in the FRG in the period under consideration. We attribute this difference in GDP per capita growth to a comparative excessive use of labor input in the GDR. This excess quantifies in a FRG labor market allocation counterfactual up to a third of consumption-equivalent welfare. We do not observe excessive physical capital input, but rather insufficient input, if misallocated at all. Further, enduring, large, unsustainable inflows into the GDR until the early 1980s maintained welfare—up to a fourth in consumption equivalents. Lastly, we quantify that consumption goods quantity constraints depress marginal utility by a fourth in the GDR. A similar effect of the labor supply constraints on the labor allocation in the FRG is comparatively low. A short discussion on GDR's deposit interest rates indicates a persistent monetary policy below the neutral interest rate. All that let us conclude that the GDR planner was biased for consumption over leisure, the present over the future, and necessity over luxury goods. In addition to these qualitative statements, our study quantifies them with substantial magnitudes in our consumption-equivalent welfare measure. Differences in business cycles are not worth mentioning.

Our study considers consumption quality and quantity, labor quality and quantity, and capital quantity, leaving capital quality out. A micro investigation of the capital quality decisions and outcomes, including the determinants of the different output elasticities, can bring important insights. Furthermore, our analysis begins in 1960, omitting the 1950s due to data limitations. However, the 1950s represented a period of rapid economic expansion, particularly in Western Europe, which likely encompassed significant developments relevant to understanding the economic consequences of Germany's and Europe's post-war division.

Lastly, we emphasize the potential of dimensionless measures—such as wedges—to compare economic performance and welfare across economic areas and systems in the presence of valuation problems.

References

Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2007) "Anlagevermögen in den Ländern und Ost-West-Großraumregionen Deutschlands," ESVG 1995, Statistische Ämter der 16 Bundesländer, Statistisches Bundesamtes und Statistisches Amt Wirtschaft und Kultur der Landeshauptstadt Stuttgart. www.vgrdl.de.

Bach, Hans-Uwe, Hans Kohler, Lutz Reyher, and Bernhard Teriet (1977) "Arbeitszeit und Arbeitsvolumen in der Bundesrepublik Deutschland 1960-1975," *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, 10, https://doku.iab.de/mittab/1977/1977_1_MittAB_Bach_Kohler_Reyher_Teriet.pdf.

Barro, Robert J (2025) "The Old Keynesian Model,"Technical report, National Bureau of Economic Research, 10.3386/w33850.

Barro, Robert J. and Herschel I. Grossman (1971) "A General Disequilibrium Model of Income and Employment," *The American Economic Review*, 61 (1), 82–93, http://www.jstor.org/stable/1910543.

Barro, Robert J and Jong-Wha Lee (1993) "International comparisons of educational attainment," *Journal of monetary economics*, 32 (3), 363–394, https://doi.org/10.1016/0304-3932(93)90023-9.

Barro, Robert J. and Xavier Sala-i Martin (2004) *Economic growth*: MIT Press, 2nd edition, https://mitpress.mit.edu/9780262025539/economic-growth.

Becker, Sascha O, Lukas Mergele, and Ludger Woessmann (2020) "The separation and reunification of Germany: Rethinking a natural experiment interpretation of the enduring effects of communism," *Journal of Economic Perspectives*, 34 (2), 143–171, https://www.jstor.org/stable/26913188.

Bergh, Andreas, Christian Bjørnskov, and Luděk Kouba (2025) "The growth consequences of socialism," *Journal of Comparative Economics*, 53 (2), 609–626, https://doi.org/10.1016/j.jce.2025.04.003.

Bick, Alexander, Nicola Fuchs-Schündeln, and David Lagakos (2018) "How Do Hours Worked Vary with Income? Cross-Country Evidence and Implications," *American Economic Review*, 108 (1), 170–99, 10.1257/aer.20151720.

Boppart, Timo and Per Krusell (2020) "Labor Supply in the Past, Present, and Future: A Balanced-Growth Perspective," *Journal of Political Economy*, 128 (1), 118–157, https://doi.org/10.1086/704071.

Bundesagentur für Arbeit (2024) "Arbeitsmarkt in Zahlen," https://statistik.arbeitsagentur.de, Reference date: March 2024.

Burda, Michael C. (2008) "What kind of shock was it? Regional integration and structural change in Germany after unification," *Journal of Comparative Economics*, 36 (4), 557–567, https://doi.org/10.1016/j.jce.2008.07.005.

Burda, Michael C and Jennifer Hunt (2001) "From reunification to economic integration: Productivity and the labor market in Eastern Germany," *Brookings papers on economic activity*, 2001 (2), 1–92, 10.1353/eca.2001.0016.

Chari, Varadarajan V, Patrick J Kehoe, and Ellen R McGrattan (2007) "Business cycle accounting," *Econometrica*, 75 (3), 781–836, https://doi.org/10.1111/j.1468-0262.2007.00768.x.

Cheremukhin, Anton, Mikhail Golosov, Sergei Guriev, and Aleh Tsyvinski (2017) "The industrialization and economic development of Russia through the lens of a neoclassical growth model," *The Review of Economic Studies*, 84 (2), 613–649, http://www.jstor.org/stable/45106737.

——— (2024) "The Political Development Cycle: The Right and the Left in People's Republic of China from 1953," *American Economic Review*, 114 (4), 1107–39, 10.1257/aer.20220249.

Cohen, Daniel and Marcelo Soto (2007) "Growth and human capital: good data, good results," *Journal of Economic Growth*, 12, 51–76, https://doi.org/10.1007/s10887-007-9011-5.

Collier, Irwin L. (1986) "Effective Purchasing Power in a Quantity Constrained Economy: An Estimate for the German Democratic Republic," *The Review of Economics and Statistics*, 68 (1), 24–32, https://doi.org/10.2307/1924924.

——— (1989) "The Measurement and Interpretation of Real Consumption and Purchasing Power Parity for a Quantity-Constrained Economy: The Case of East and West Germany," *Economica*, 56 (221), 109–120, http://www.jstor.org/stable/2554499.

——— (2012) "The DM and the Ossi Consumer: Price Indexes During Transition," *Journal of Economic Integration*, 27 (2), 245–273, http://www.jstor.org/stable/41493888.

del Río, Fernando and Francisco-Xavier Lores (2023) "Accounting for spanish economic development 1850–2019," *Economic Modelling*, 121, 106200, https://doi.org/10.1016/j.econmod.2023.106200.

Dietzenbacher, Erik and Hans-Jürgen Wagener (1999) "Prices in the Two Germanies," *Journal of Comparative Economics*, 27 (1), 131–149, https://doi.org/10.1006/jcec.1998.1562.

Dohmen, Thomas, Armin Falk, David Huffman, Uwe Sunde, Jürgen Schupp, and Gert G. Wagner (2011) "Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences," *Journal of the European Economic Association*, 9 (3), 522–550, https://doi.org/10.1111/j.1542-4774.2011.01015.x.

Easterly, William and Stanley Fischer (1994) "The Soviet Economic Decline: Historical and Republican Data," Working Paper 4735, National Bureau of Economic Research, 10.3386/w4735.

Fehrle, Daniel and Vasilij Konysev (2025) "To converge or not to converge: Accounting for the German reunification," Discussion Paper Series 348, Universitaet Augsburg, Institute for Economics, https://opus.bibliothek.uni-augsburg.de/opus4/frontdoor/deliver/index/docId/121337/file/121337.pdf.

Fernández-Villaverde, Jesús, Dario Laudati, Lee Ohanian, and Vincenzo Quadrini (2023) "Accounting for the Duality of the Italian Economy," *Review of Economic Dynamics*, 50, 267–290, https://doi.org/10.1016/j.red.2023.07.009.

Fisher, Jonas D.M and Andreas Hornstein (2002) "The Role of Real Wages, Productivity, and Fiscal Policy in Germany's Great Depression 1928–1937," *Review of Economic Dynamics*, 5 (1), 100–127, https://doi.org/10.1006/redy.2001.0142.

Friehe, Tim and Markus Pannenberg (2020) "Time preferences and political regimes: Evidence from reunified Germany," *Journal of Population Economics*, 33, 349–387, https://doi.org/10.1007/s00148-019-00728-7.

Fuchs-Schündeln, Nicola and Tarek Alexander Hassan (2016) “Natural experiments in macroeconomics,” in *Handbook of Macroeconomics*, 2, 923–1012: Elsevier, https://doi.org/10.1016/bs.hesmac.2016.03.008.

de la Fuente, Angel and Rafael Doménech (2006) “Human Capital in Growth Regressions: How Much Difference Does Data Quality Make?” *Journal of the European Economic Association*, 4 (1), 1–36, http://www.jstor.org/stable/40004950.

Glitz, Albrecht and Erik Meyersson (2020) “Industrial Espionage and Productivity,” *American Economic Review*, 110 (4), 1055–1103, 10.1257/aer.20171732.

Gregory, Paul and Gert Leptin (1977) “Similar Societies under Differing Economic Systems: The Case of the Two Germanys,” *Soviet Studies*, 29 (4), 519–542, http://www.jstor.org/stable/150534.

Hall, Robert E. and Charles I. Jones (1999) “Why do Some Countries Produce So Much More Output Per Worker than Others?*,” *The Quarterly Journal of Economics*, 114 (1), 83–116, 10.1162/003355399555954.

Heer, Burkhard and Alfred Maußner (2009) *Dynamic General Equilibrium Modeling: Computational Methods and Applications*: Springer Berlin, Heidelberg, 2nd edition, https://doi.org/10.1007/978-3-540-85685-6.

——— (2024) *Dynamic General Equilibrium Modeling: Computational Methods and Applications*: Springer Cham, 3rd edition, https://doi.org/10.1007/978-3-031-51681-8.

Heske, Gerhard (2009) “Volkswirtschaftliche Gesamtrechnung DDR 1950-1989: Daten, Methoden, Vergleiche,” *Historical Social Research, Supplement*, 21, https://nbn-resolving.org/urn:nbn:de:0168-ssoar-285875.

Howard, David H. (1977) “Rationing, Quantity Constraints, and Consumption Theory,” *Econometrica*, 45 (2), 399–412, http://www.jstor.org/stable/1911217.

Indarte, Sasha, Raymond Kluender, Ulrike Malmendier, and Michael Stepner (2025) “Consumption Wedges: Measuring and Diagnosing Distortions,” https://www.dropbox.com/scl/fi/5coh5sit15af5l18qw1l2/IKMS-Consumption-Wedges-June-2025.pdf?rlkey=sz5botlnge0aghy9jw00ti6f9&e=1&st=2ddsw2ce&dl=0.

Jarosch, Gregor, Laura Pilossoph, and Anthony Swaminathan (2025) "Should Friday be the New Saturday? Hours Worked and Hours Wanted," Working Paper 33577, National Bureau of Economic Research, 10.3386/w33577.

Kukić, Leonard (2018) "Socialist growth revisited: insights from Yugoslavia," *European Review of Economic History*, 22 (4), 403–429, 10.1093/ereh/hey001.

——— (2020) "Origins of regional divergence: economic growth in socialist Yugoslavia," *The Economic History Review*, 73 (4), 1097–1127, https://doi.org/10.1111/ehr.12967.

Ljungqvist, Lars and Thomas J. Sargent (2007) "Understanding European unemployment with matching and search-island models," *Journal of Monetary Economics*, 54 (8), 2139–2179, https://doi.org/10.1016/j.jmoneco.2007.09.001.

Lu, Shu-Shiuan (2012) "East Asian growth experience revisited from the perspective of a neoclassical model," *Review of Economic Dynamics*, 15 (3), 359–376, https://doi.org/10.1016/j.red.2012.04.002.

Merkel, Wilma and Stefanie Wahl (1991) *Das geplünderte Deutschland: Die wirtschaftliche Entwicklung im östlichen Teil Deutschlands von 1949 bis 1989*: IWG, https://books.google.de/books?id=9gmLAAAAIAAJ.

Müller, Karsten, Chenzi Xu, Mohamed Lehbib, and Ziliang Chen (2025) "The Global Macro Database: A New International Macroeconomic Dataset," Working Paper 33714, National Bureau of Economic Research, https://doi.org/10.3386/w33714.

Ofer, Gur (1987) "Soviet economic growth: 1928-1985," *Journal of Economic Literature*, 25 (4), 1767–1833, https://www.jstor.org/stable/2726445.

Ohanian, Lee E., Paulina Restrepo-Echavarria, and Mark L. J. Wright (2018) "Bad Investments and Missed Opportunities? Postwar Capital Flows to Asia and Latin America," *American Economic Review*, 108 (12), 3541–82, 10.1257/aer.20151510.

Plassard, Romain and Matthieu Renault (2023) "General equilibrium models with rationing: The making of a 'European specialty'," *European Economic Review*, 159, 104570, https://doi.org/10.1016/j.euroecorev.2023.104570.

Pohl, Reinhard (1984) *Handbuch DDR-Wirtschaft*, Hamburg: Rohwold, 4th edition, https://www.econbiz.de/Record/handbuch-ddr-wirtschaft-pohl-reinhard/10000076457.

del Río, Fernando and Francisco-Xavier Lores (2021) "Accounting for US economic growth 1954–2017," *Economic Modelling*, 101, 105529, https://doi.org/10.1016/j.econmod.2021.105529.

Schmalwasser, Oda (2001) "Revision der Anlagevermögensrechnung 1991 bis 2001," *Wirtschaft und Statistik*, 5, 342–356, https://www.destatis.de/DE/Methoden/WISTA-Wirtschaft-und-Statistik/2012/11/revision-anlagevermoegensrechnung-112012.pdf?__blob=publicationFile.

Schwarzer, Oda (1999) *Sozialistische Zentralplanwirtschaft in der SBZ/DDR: Ergebnisse eines ordnungspolitischen Experiments (1945-1989)*, Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte: Beihefte: Franz Steiner Verlag, https://books.google.de/books?id=JyY75n1snsQC.

Seton, Francis (1985) *Cost, Use, and Value. The Evaluation of Performance, Structure, and Prices Across Time, Space, and Economic Systems*: Clarendon Press, https://books.google.de/books?id=VTMtAAAAMAAJ.

Sleifer, Jaap (2006) *Planning Ahead and Falling Behind: The East German Economy in Comparison with West Germany 1936-2002*, Berlin: Akademie Verlag, https:/doi.org/10.1524/9783050085395.

Staatliche Zentralverwaltung für Statistik (1980) "Statistisches Jahrbuch des gesellschaftlichen Gesamtproduktes und des Nationaleinkommens," Federal Archiv, BArch DE/02/22302.

Staatliche Zentralverwaltung für Statistik (1968) "Probleme der Durchsetzung strukturpolitischer Hauptrichtungen," Federal Archiv, BArch DE/02/30075.

——— (1990) "Statistisches Jahrbuch des gesellschaftlichen Gesamtproduktes und des Nationaleinkommens," Staatliche Zentralverwaltung für Statistik, Berlin.

Statistisches Bundesamt (1991) "Inlandsproduktsberechnung Revidierte Ergebnisse 1950 bis 1990," *Volkswirtschaftliche Gesamtrechnungen Fachserie 18 Reihe 1.5*, https://www.destatis.de/DE/Themen/Wirtschaft/Volkswirtschaftliche-Gesamtrechnungen-Inlandsprodukt/Publikationen/Downloads-Inlandsprodukt/inlandsprodukt-lange-reihen-pdf-218015 pdf?__blob=publicationFile.

——— (1994) "Erwerbstätige 1950 bis 1989," *Sonderreihe mit Beiträgen für das Gebiet der ehemaligen DDR*, 14, https://www.statistischebibliothek.de/mir/servlets/MCRFileNodeServlet/DEMonografie_derivate_00000971/Heft_14.pdf.

——— (2000) "Entstehung und Verwendung des Bruttoinlandsprodukts 1970 bis 1989," *Sonderreihe mit Beiträgen für das Gebiet der ehemaligen DDR*, 33, https://www.statistischebibliothek.de/mir/receive/DEMonografie_mods_00002426.

——— (2006) "Inlandsproduktsberechnung revidierte Ergebnisse 1970 bis 1991," *Volkswirtschaftliche Gesamtrechnungen Fachserie 18 Reihe S.29*, https://www.destatis.de/DE/Themen/Wirtschaft/Volkswirtschaftliche-Gesamtrechnungen-Inlandsprodukt/Publikationen/Downloads-Inlandsprodukt/inlandsprodukt-revidiert-jahr-21890299 xlsx?__blob=publicationFile&v=5.

Voskoboynikov, Ilya B. (2021) "Accounting for growth in the USSR and Russia, 1950–2012," *Journal of Economic Surveys*, 35 (3), 870–894, https://doi.org/10.1111/joes.12426.

Šustek, Roman (2011) "Monetary business cycle accounting," *Review of Economic Dynamics*, 14 (4), 592–612, https://doi.org/10.1016/j.red.2010.10.001.

Zhuravskaya, Ekaterina, Sergei Guriev, and Andrei Markevich (2024) "New Russian Economic History," *Journal of Economic Literature*, 62 (1), 47–114, 10.1257/jel.20221564.

A Data appendix

A.1 Data for the FRG

A.1.1 Data sources

The data on the national accounts and human capital for the FRG in 1960–1989 rely on various primary sources:

- Statistisches Bundesamt (2006) reports the SNA (ESA 1995), yet only available from 1970 – 1991.
- Statistisches Bundesamt (1991) reports the SNA (ESA 1976), yet only available from 1960 – 1990 and without labor market statistics.
- Bach et al. (1977) provides labor market statistics from 1960 – 1976.
- Barro and Lee (1993) provide the average years of school enrollment of the population of the FRG.
- Bundesagentur für Arbeit (2024) provides data on unemployment and employment in the FRG.
- Deutsche Bundesbank Long time series Dataset (March 2025) provides money market interest rates and consumer price inflation for the FRG.

A.1.2 Data preparation

We present real values of all quantities in prices in Deutsche Mark in 1989 (market price). We construct real indices of the SNA statistics before 1970 in quantities of 1970 and calculate then backward the quantities in Deutsche Mark in 1989 and construct a time series of the replacement value of the capital stock by applying the perpetual inventory method backward from the stock reported in Statistisches Bundesamt (2006) for 1991.

We use cubic splines to interpolate annually between the 5-year reports of Barro and Lee (1993).

A.1.3 Data quality

We consider the quality of the data sources as high as all national accounts sources are from the German Federal Statistical Office or the Institute for Employment Research (IAB) of the Federal Employment Agency (BA). However, we address data quality for two reasons. First, parts of our data have undergone revisions over time. Regrettably, data concerning the complementary GDR has not undergone these revision processes, leading to a trade-off between outdated primary sources or inconsistency between the GDR and the FRG. Second, our database relies on various sources, so ensuring consistency is critical. Lastly, we discuss the effects of the interpolation.

Concerning the former, the data on national accounts follows SNA ESA 1995 only from 1970 onward, earlier data follows SNA ESA 1976. As we enhance the time series backward with an index (1970=100) not with the use of the levels, there is no structural break due to accounting rules between 1969 and 1970. Generally, the data inconsistency should be small as we use highly aggregated measures.

Further, more recent ESA revisions are not available for this period, neither for the FRG nor GDR. Yet, there are several revises on the data on the average years of school enrollment from Barro and Lee (1993) due to criticism for their construction (e.g., de la Fuente and Doménech, 2006; Cohen and Soto, 2007). However, the critique unfolds mainly on implausible results for individual countries. Since this is not the case for either of the two German countries, we are not aware of any better data for the GDR, and to be consistent with the GDR data, the work of Barro and Lee (1993) is the best available source for our purpose. As Barro and Lee (1993) calculate the average years of schooling with the perpetual inventory method, the evolution is smooth, so the effects of the interpolation are minor for average years of schooling.

A.2 Examples published and confidential SZS material

Published “Zahlen und Fakten zur Entwicklung der DDR (1979)” (BArch DE/22302)

Oberschulbildung für alle Kinder

Mit dem Aufbau der zehnklassigen Oberschule wurden günstige Bedingungen für eine hohe Bildung der Arbeiterklasse und des ganzen Volkes geschaffen. Das ist eine historische Leistung unseres Arbeiter-und-Bauern-Staates, die dem Wesen der sozialistischen Gesellschaftsordnung entspricht. Die zehnjährige polytechnische Oberschulbildung für alle Kinder dient der Verwirklichung unseres erklärten Zieles, den allseitig entwickelten Menschen heranzubilden.

“Secondary school education for all children
The establishment of the ten-class secondary school created favorable conditions for a high level of education for the working class and the people as a whole. This is a historic achievement of our workers’ and peasants’ state, which corresponds to the spirit of the socialist social order. The ten-year polytechnic secondary school for all children serves the realization of our declared goal of forming the universally developed human being.”

Published “Zahlen und Fakten zur Entwicklung der DDR (1979)” (BArch DE/22302)

och- und Fachschulstudium

as Hoch- und Fachschulwesen hat in der DDR einen beispielhaften ufschwung genommen. Allein die Zahl der Universitäten und Hochchulen erhöhte sich in den 30 Jahren des Bestehens der DDR von 8 auf 53.

University and university of applied sciences studies
Higher and specialized education has experienced an exemplary upswing in the GDR. The number of universities and universities of applied sciences alone increased from 8 to 53 in the 30 years of the GDR’s existence.

Classified “Ergänzendes Material, Arbeitsmaterialien zur Vorbereitung ... (Zentralkomiteekonferenz, 1968)” (BArch DE/22302)

Die Zuführung neuer Produktionskapazitäten in den letzten Jahren hat den hohen Nachholebedarf an Automatisierungs- und Rationalisierungsmitteln nicht beseitigen können. Die Altersstruktur der Maschinen und Ausrüstungen in der DDR ist ungünstiger als in anderen hochentwickelten Industrieländern.

“ ... The age structure of machines and equipment in the GDR is unfavorably compared to other highly developed industrial countries.”

Classified “Ergänzendes Material, Arbeitsmaterialien zur Vorbereitung ... (Zentralkomiteekonferenz, 1968)” (BArch DE/22302)

Der bereits hohe Nachholebedarf an Automatisierungs- und Rationalisierungsmitteln hat sich in den Jahren 1966/67 durch die unplanmäßige Produktionsentwicklung wichtiger Erzeugnisse für die Rationalisierung nur geringfügig verringert.

“ The already high backlog demand for automatization and rationalization facilities was only slightly reduced in 1966/67 due to the unplanned development of production of important products for rationalization.”

B COMPUTATIONAL DETAILS

This section describes our quantitative implementation and simulation of the accounting models. First, we provide the remaining steady-state values of our models' variables. Second, we compute the models' transition paths to the steady state. Third, we solve the nonlinear deterministic models assuming actual and counterfactual paths of the wedges. Finally, we give a brief overview of the counterfactuals presented in the paper. This procedure is in line with Fehrle and Konysev (2025).

B.1 Steady state

Given the target values from Table 2 and computation steps described in Section 4.1, we compute the steady-state values listed in Table A.1.

Table A.1: Steady states of both Germanies

Variable	Value		Description
	GDR	FRG	
k	183774	239874	Real capital stock per capita
c	9521	19032	Real private consumption per capita
i	4961	6886	Real investment per capita
$\alpha\frac{y}{k}$	0.038	0.040	Marginal product of capital
$(1-\alpha)\frac{y}{l}$	10.53	32.23	Marginal product of labor
ω^e	0.993	3.904	Productivity wedge
ω^L	2.113	1.004	Labor market wedge
ω^K	1.005	1.003	Capital market wedge
ω^D	–0.043	0.039	Residual demand-to-GDP ratio (net exports)

Notes: Level magnitudes $\{k, c, i, \omega^e\}$ are valued by constant local prices: By the domestic currency Ostmark (DDM) in 1989 in the GDR and by the Deutsche Mark (DEM) in 1989 in the FRG.

B.2 Computation of paths after T

In our wedge accounting exercise in section 4 all 32 variables and time-varying-parameters of the model in periods $t = 0 \ldots T$ are either observed or deduced from the system (7). We assume that after period T our model economy converges to the steady state listed in Appendix B.1, satisfying system (7). Adopting the methodology proposed by del Río and Lores (2021), we project the paths of the variables $\{\Upsilon_t\}_{t=T+1}^{T_1}$ using the exponential convergence formula

$$\Upsilon_t = \Upsilon_T e^{-\lambda(t-T)} + \Upsilon - \Upsilon e^{-\lambda(t-T)},\ T \leq t \leq T_1,$$

where $\Upsilon_t \in \{y_{it},\ c_{it},\ i_{it},\ l_{it},\ s_{it},\ \delta_{it},\ g_{iNt+1},\ \omega_{it}^G,\ \omega_{it}^{QL},\ \omega_{it}^{QC}\}$ and λ denotes the convergence speed. We follow del Río and Lores (2021) and del Río and Lores (2023) and set $\lambda = 0.03$, an order of magnitude that is standard in the literature (see Barro and Sala-i Martin, 2004, Chapter 11). T_1 is the terminal period before the variables Υ_t enter the steady state by assumption, i.e., $\{\Upsilon_t\}_{t=T_1+1}^{\infty} = \Upsilon$. As a result, we determine the variables Υ_t ranging from $t = 0$ to $t = \infty$. Using the subset $\{i_{it},\ \delta_{it},\ g_{iNt+1}\}_{t=0}^{T_1}$, we derive $\{k_{it+1}\}_{t=0}^{T_1}$ from the capital law-of-motion (7d) for given initial value k_{i0}. We set the terminal period to $T_1 = T + 700$, ensuring that the deviation of the terminal capital stock k_{iT_1+1} from its exact steady-state value k_i remains numerically small— specifically, less than 10^{-7} % of the steady-state value. We compute the sequence of government consumption level $\left\{g_{it}\right\}_{t=0}^{T_1}$ from equation (7f). Afterward, we solve the equations (7a), (7b), (7c), and (7e) for the sequences of wedge $\{\omega_{it}^L,\ \omega_{it}^e,\ \omega_{it}^D\}_{t=0}^{T_1}$, and $\{\omega_{it+1}^K\}_{t=0}^{T_1-1}$. For the terminal value of the capital wedges, we assume that it satisfies the steady-state versions of the Euler equation (7b). Hence, $\omega_{iT_1+1}^K = \frac{1}{\beta_i} / \left(\alpha_i \frac{y_i}{k_i} + (1-\delta_i)\right)$. By proceeding in this manner, the values of all variables and time-varying parameters are determined for $t = 0, \ldots, \infty$ given the set of constant parameters.

B.3 Computation of the transition dynamics given counterfactuals

In our counterfactual exercises, we specify sequences of wedges along counterfactual paths denoted with upper bars in the main text. Therefore, we need a solver to compute the counterfactual transition dynamics of our models' endogenous variables, given the initial per-capita capital stock k_{i0}, the constant parameters $\{\beta_i,\ \ \theta_i,\ \ \bar{l},\ \ \alpha_i,\ \ \gamma_1,\ \ \gamma_2,\ \gamma_3\}$, sequences of (partly counterfactual) wedges, and that the transversality condition $\lim_{s\to\infty} \beta^s \frac{k_{it+1+s}}{g_{it+s}+c_{it+s}} = 0$ hold. The solutions for the GDR and the FRG of the equation system (7) involve separately choosing sequences $\{k_{it+1}\}_{t=0}^{T_1-1}$ and $\{l_{it}\}_{t=0}^{T_1}$. After plugging equation (7d) in (7e) (eliminating i_{it}), then in (7a) and (7b) (eliminating c_{it} and g_{it}) and substituting equation (7c) for all y_{it}, the sequences of capital and labor have to satisfy the following reduced system:

$$
\begin{aligned}
&(1-\alpha)\omega_{it}^{e}\omega_{it}^{L}h_{it}^{1-\alpha_i}\Big(\frac{k_{it}}{l_{it}}\Big)^{\alpha_i}\\
&=\frac{\theta_i(1-\omega_{it}^{D})\omega_{it}^{e}k_{it}^{\alpha_i}(h_{it}l_{it})^{1-\alpha_i}-g_{iNt+1}k_{it+1}+(1-\delta_{it})k_{it}}{\bar{l}-l_{it}}\frac{\omega_{it}^{QC}}{\omega_{it}^{QL}}, \qquad \text{(A.1a)}\\
&t=0,1,\dots T,T+1,\dots,T_1,\\
&\beta_i\omega_{it+1}^{K}\Big[1-\delta_{it+1}+\alpha_i\omega_{it+1}^{e}\Big(\frac{k_{it+1}}{h_{it+1}l_{it+1}}\Big)^{\alpha_i-1}\Big]\frac{\omega_{it+1}^{QC}}{\omega_{it}^{QC}}\\
&=\frac{(1-\omega_{it+1}^{D})\omega_{it+1}^{e}k_{it+1}^{\alpha_i}(h_{it+1}l_{it+1})^{1-\alpha_i}-g_{iNt+2}k_{it+2}+(1-\delta_{it+1})k_{it+1}}{(1-\omega_{it}^{D})\omega_{it}^{e}k_{it}^{\alpha_i}(h_{it}l_{it})^{1-\alpha_i}-g_{iNt+1}k_{it+1}+(1-\delta_{it+1})k_{it}}, \qquad \text{(A.1b)}\\
&t=0,1,\dots T,T+1,\dots,T_1-1,\\
&k_{iT_1+1}=k_{iT_1}, \qquad \text{(A.1c)}\\
&\text{given } k_{i0}. \qquad \text{(A.1d)}
\end{aligned}
$$

Note that assuming that the equation system converges to a steady state at some date T_1+1, reduces an infinite number of equations and unknowns to a finite number. The terminal condition of capital stock converging to its steady state (A.1c) ensures that the transversality condition holds (see Heer and Maußner, 2024, Chapter 6.2). Given the two sequences for each region i, all remaining variables on both sides of the equations (A.1a)–(A.1b) are either exogenous variables or time-varying parameters (here the actual ones without upper bars).

We solve the nonlinear equation system with $2\times T_1$ unknowns for all periods simultaneously by employing the gradient-based solver proposed by Heer and Maußner (2024, Algorithm 15.3.2) for the stacked nonlinear equation system.

Given a solution of system (A.1), the remaining endogenous variables are computed as follows. With sequences for k_{it} and l_{it}, we calculate $\{y_{it}\}_{t=0}^{T_1}$ using the production function (7c). Next, we uncover $\{g_{it}\}_{t=0}^{T_1}$ from equation (7f), which allows us to compute $\{c_{it}\}_{t=0}^{T_1}$ from the labor supply condition (7a). Finally, we derive $\{i_{it}\}_{t=0}^{T_1}$ from the resource constraint (7e). [22]

[22]The MATLAB and Gauss programs used in this study are available from the authors upon request.

B.4 Summary of counterfactuals

For our counterfactual experiments described in the main text and displayed in Figures 4, A.1, A.2, A.6, A.8, A.3 and A.4 we change the following trajectories of exogenous variables with $i, j \in \{E, W\}$ and $i \neq j$. Recall that we denote counterfactuals with upper bars.

- Counterfactual "Zero residual demand wedge": We set $\{\bar{\omega}_{it}^{D}\}_{t=0}^{T_1} = 0$.
- Counterfactual "TFP growth in i from j": We assume $\bar{\omega}_{i0}^{e} = \omega_{i0}^{e}$ and use growth factors $\left\{\frac{\omega_{jt+1}^{e}}{\omega_{jt}^{e}}\right\}_{t=0}^{T_1-1}$ to reconstruct the series $\{\bar{\omega}_{it}^{e}\}_{t=0}^{T_1}$.
- Counterfactual "Capital Wedge in i from j": We set $\{\bar{\omega}_{it+1}^{K}\}_{t=0}^{T_1-1} = \{\omega_{jt+1}^{K}\}_{t=0}^{T_1-1}$.
- Counterfactual "Labor wedge in i from j": We replace $\{\bar{\omega}_{it+1}^{L}\}_{t=0}^{T_1} = \{\omega_{jt+1}^{L}\}_{t=0}^{T_1}$.
- Counterfactual "TFP growth off in i": We set $\{\bar{\omega}_{it}^{e}\}_{t=0}^{T_1} = \omega_{i0}^{e}$.
- Counterfactual "Labor wedge off in i": We set $\{\bar{\omega}_{it}^{L}\}_{t=0}^{T_1} = \omega_{i}^{L}$.
- Counterfactual "Capital wedge off in i": We set $\{\bar{\omega}_{it+1}^{K}\}_{t=0}^{T_1-1} = \omega_{i}^{K}$.
- Counterfactual "All off in i": We set $\{\bar{\omega}_{it}^{e}\}_{t=0}^{T_1} = \omega_{i0}^{e}$, $\{\bar{\omega}_{it}^{L}\}_{t=0}^{T_1} = \omega_{i}^{L}$ and $\{\bar{\omega}_{it+1}^{K}\}_{t=0}^{T_1-1} = \omega_{i}^{K}$.
- Counterfactual "no consumption rationing": We set $\{\bar{\omega}_{it}^{QC}\}_{t=0}^{T_1} = 1$ for $i = E$.
- Counterfactual "no labor rationing": We set $\{\bar{\omega}_{it}^{QL}\}_{t=0}^{T_1} = 1$ for $i = W$.

C COUNTERFACTUAL ANALYSIS FRG

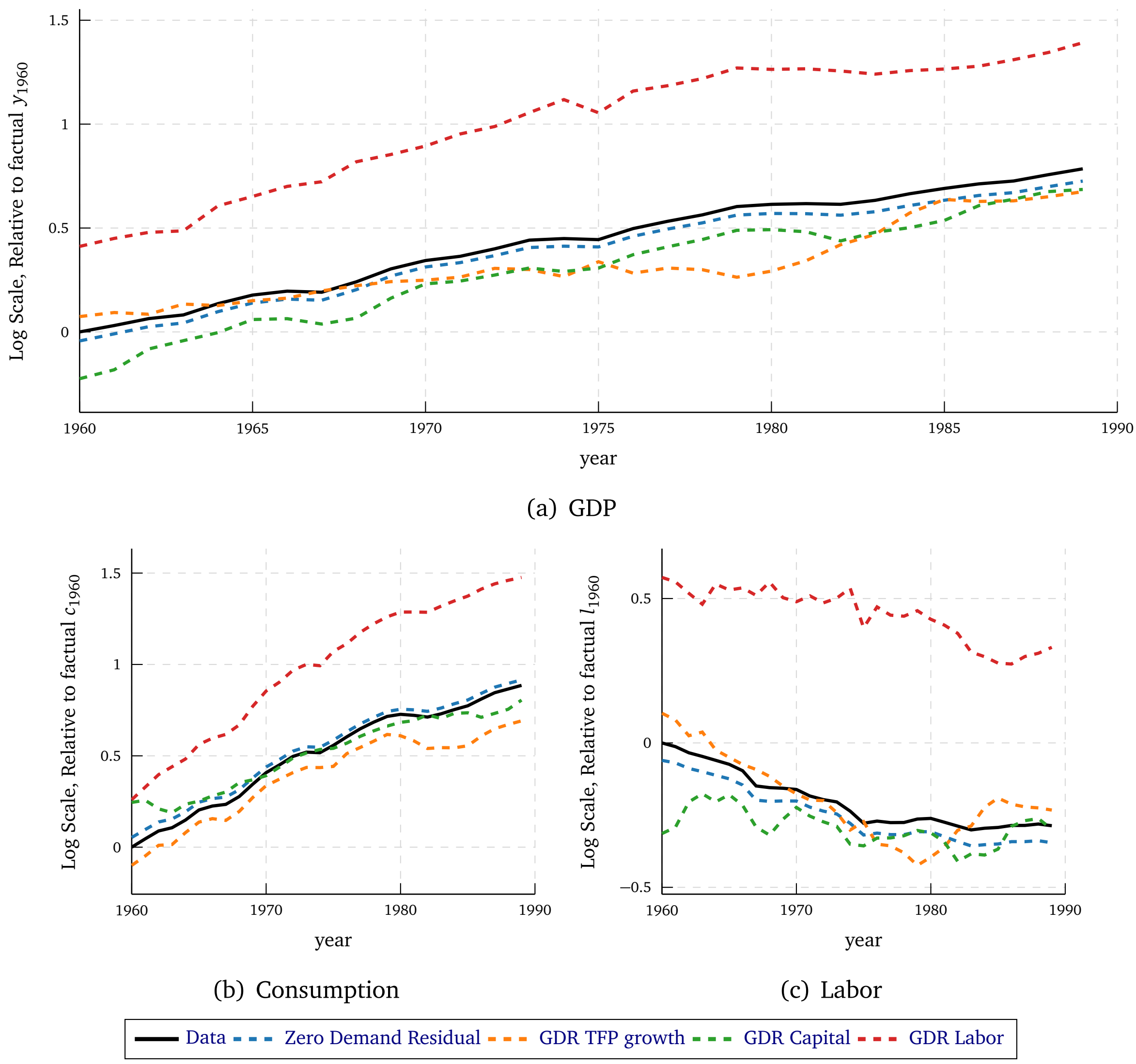
This Appendix illustrates the counterfactual analysis for the FRG with GDR's wedges mentioned in Section 5.2. Figure A.1 presents, analogously to Figure 4 in the main text, the counterfactual trajectories of FRG's GDP, private consumption and hours worked per capita.

Note that in some counterfactual scenarios, investments turn slightly negative, meaning households take advantage of the opportunity to convert capital stock into consumption goods, which we permit.[23] Fehrle and Konysev (2025) discuss alternative approaches to

[23]The capital stock itself always remains positive.

addressing issues with negative quantities, such as imposing non-negativity constraints or combining multiple counterfactual wedges to ensure strictly positive quantities. However, since the present counterfactual analysis for FRG is the reverse of the analysis for the GDR in the main body of the paper, where all quantities are strict positive, we refrain from introducing additional constraints or more complex counterfactuals for the sake of simplicity.

Figure A.1: Counterfactual outcomes in the FRG



(a) GDP

(b) Consumption

(c) Labor

Table A.2 reports, analogously to Tables 3 and 4, the welfare analysis for the FRG.

Table A.2: Consumption equivalent welfare measures for the FRG

Counterfactual	Welfare measure in %				
	Δ^1	Δ^2	Δ^3	Δ^4	Δ^5
Zero residual	5.59	6.64	6.70	6.49	6.54
No TFP growth	-53.96	-37.02	-37.33	-36.64	-36.90
TFP growth from GDR	-26.32	-11.54	-11.57	-11.85	-11.87
Capital wedge from GDR	0.44	8.17	8.62	6.53	6.92
Labor wedge from GDR	-26.28	-40.46	-40.68	-39.02	-39.23

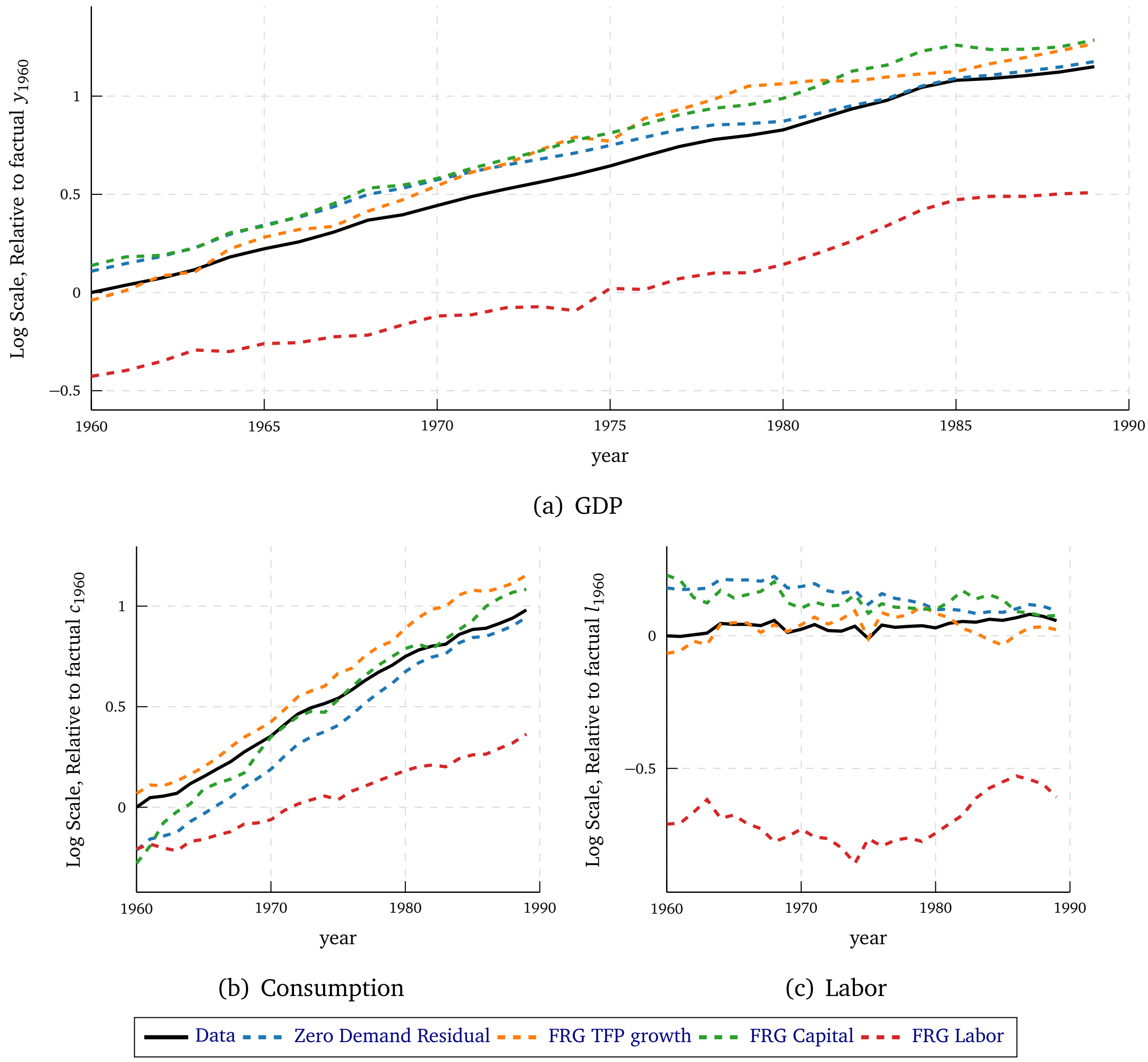
Notes: Δ^1 captures discounted total consumption equivalence until infinity (equation (10a)).Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)), Δ^3 captures discounted per capita consumption equivalence for the considered period ($N_{it} = 1,\ \forall t, i$), and Δ^4 captures non-discounted total consumption equivalence for the considered period ($\beta_= 1 \forall i$), Δ^5 captures non-discounted per capita consumption equivalence for the considered period ($\beta_i = 1 = N_{it} = 1,\ \forall t, i$).

D Sensitivity analysis

D.1 Other TFP measure (Solow residual)

This section shows the results implied by the usage of usual instead of human capital-adjusted TFP measures as we discuss in our robustness checks. Figure A.2 illustrates our counterfactual exercise – in comparison to Figure 4 – plotting the new counterfactual paths of GDP, consumption and hours worked per capita.

Figure A.2: Robustness, Solow residual: Counterfactual outcomes in the GDR



(a) GDP

(b) Consumption

(c) Labor

Table A.3 shows all consumption–equivalent welfare measures.

Table A.3: Robustness, Solow residual: Consumption equivalent welfare measures for the GDR

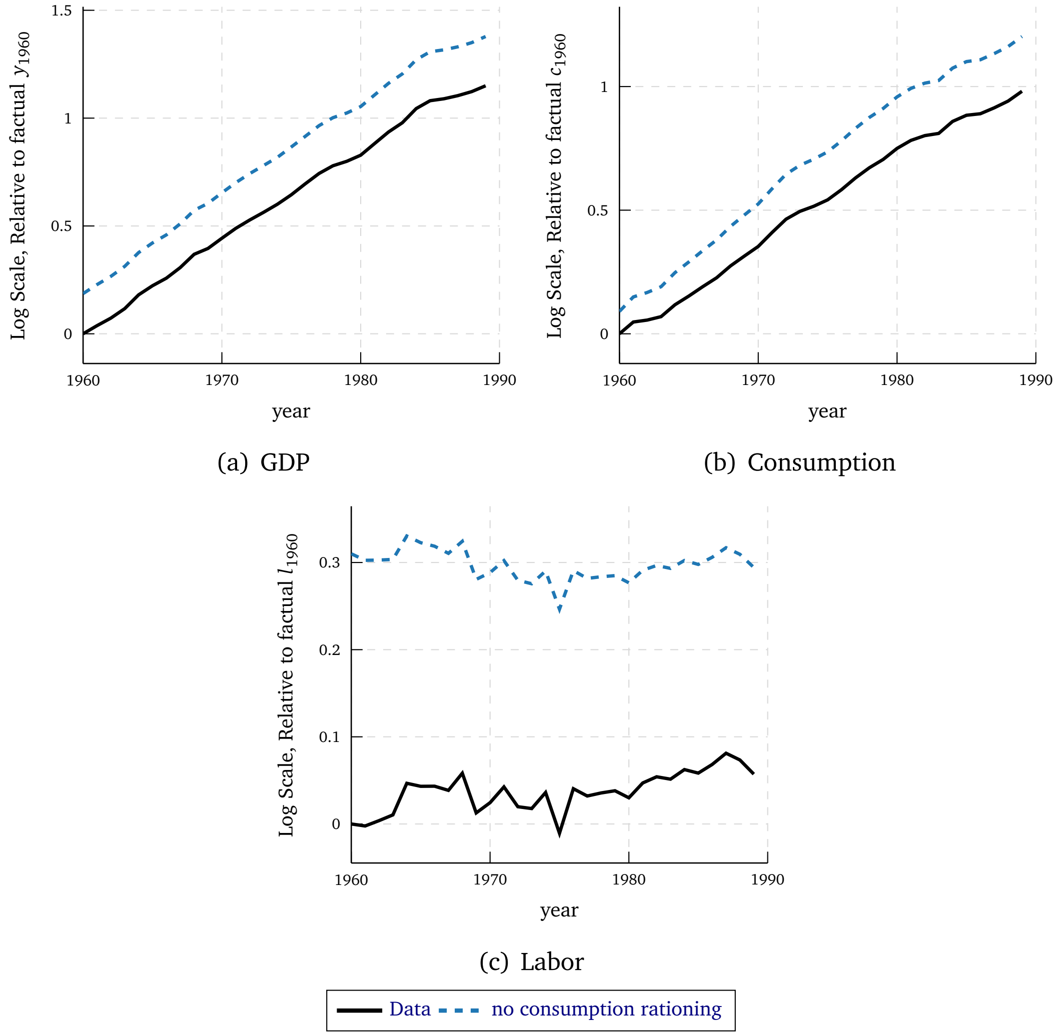
Counterfactual	Welfare measure in %				
	Δ^1	Δ^2	Δ^3	Δ^4	Δ^5
Zero residual	-14.79	-23.88	-23.77	-22.63	-22.52
No TFP growth	-46.53	-29.27	-29.24	-28.84	-28.81
TFP growth from FRG	29.72	11.98	12.04	12.75	12.81
Capital wedge from FRG	-0.62	-13.87	-13.75	-12.35	-12.23
Labor wedge from FRG	22.03	37.91	37.73	35.79	35.61

Notes: Δ^1 captures discounted total consumption equivalence until infinity (equation (10a)).Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)), Δ^3 captures discounted per capita consumption equivalence for the considered period ($N_{it} = 1,\ \forall t, i$), and Δ^4 captures non-discounted total consumption equivalence for the considered period ($\beta_= 1 \forall i$), Δ^5 captures non-discounted per capita consumption equivalence for the considered period ($\beta_i = 1 = N_{it} = 1,\ \forall t, i$).

D.2 No quantity constraints

This section presents the results from exercises where quantity constraints are disregarded. Figure A.3 illustrates – in addition to Figure 4 – the counterfactual exercise of simply shutting off the consumption quantity constraint wedge in our baseline model described in Equations (7).

Figure A.3: Quantity constraint wedge's contributions in the GDR



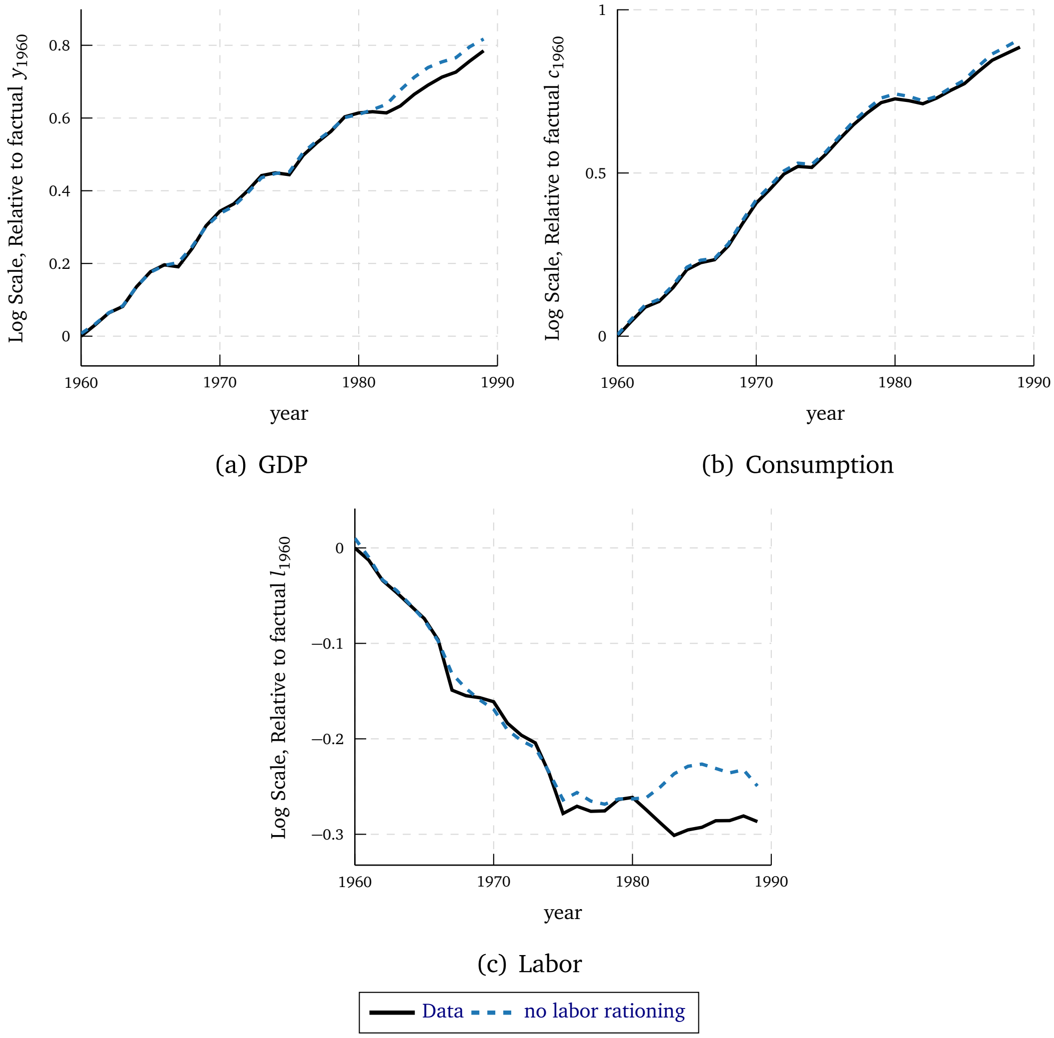
(a) GDP

(b) Consumption

(c) Labor

Figure A.4 illustrates – in addition to Figure A.1 – the counterfactual exercise of shutting off the labor quantity constraint wedge, plotting the new counterfactual paths of GDP, consumption and hours worked per capita of the FRG. Note that Figures A.3 and A.4 come from simulations of our baseline model with accounting wedges presented in Figure 3, so the accounting labor wedges do not change.

Figure A.4: Quantity constraint wedge's contributions in the FRG



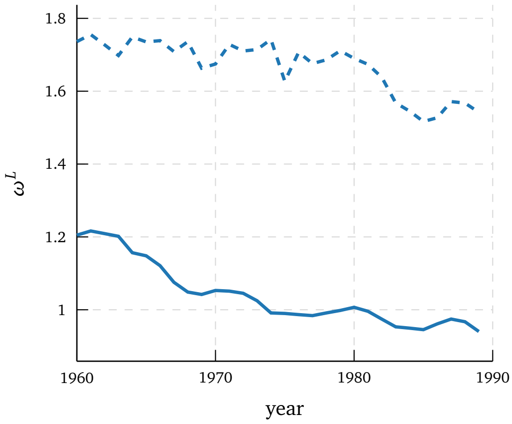
(a) GDP

(b) Consumption

(c) Labor

Next, we present our results from models without any quantity constraints, i.e our baseline models with $\omega_{it}^{QC} = \omega_{it}^{QL} = 1, \forall t, i$. Figure A.5 illustrates the new accounting labor wedges for both Germanies as they are the only accounting wedges that change in comparison to those from Figure 3.

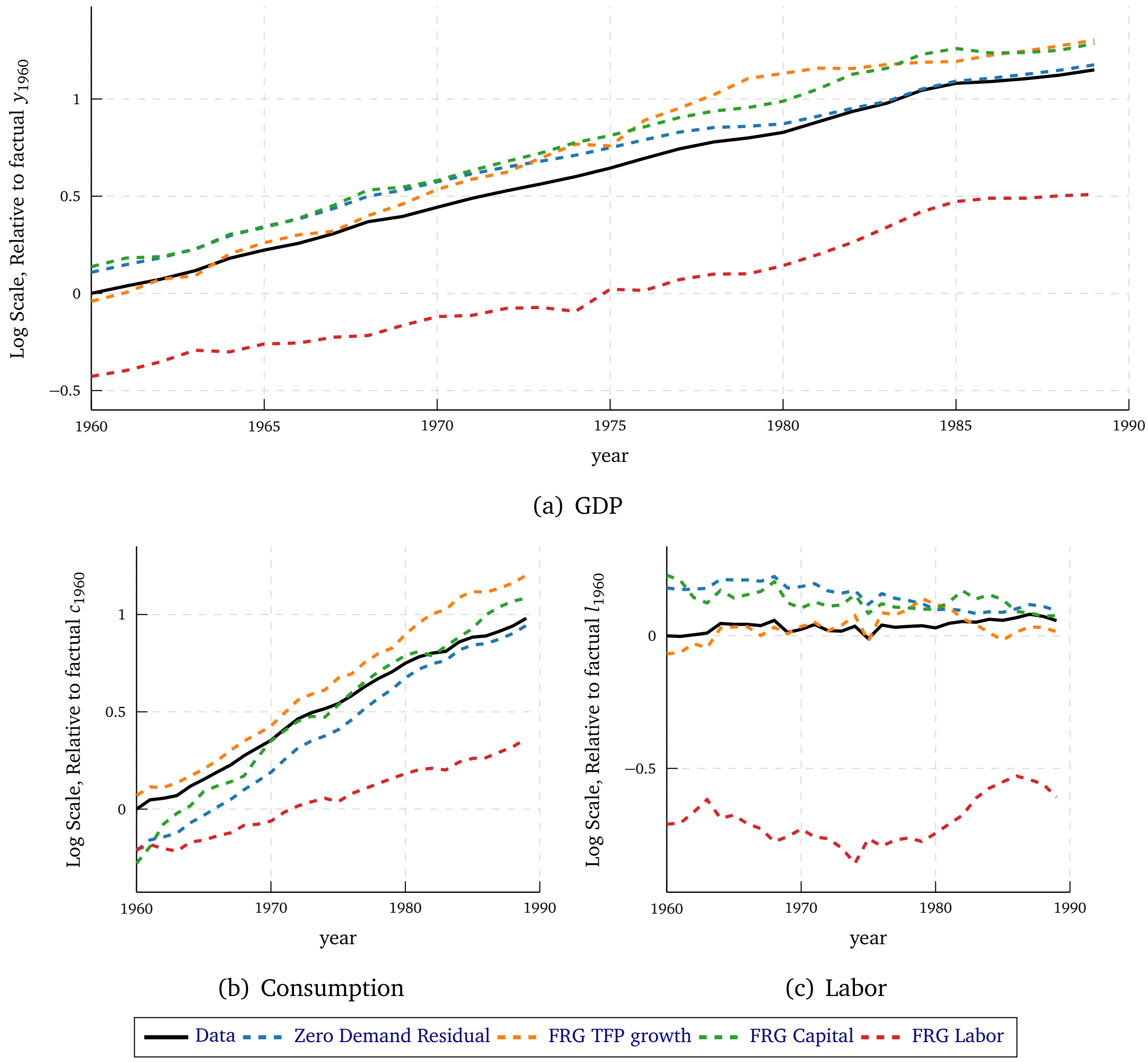
Figure A.5: Robustness, no quantity constraint: Wedge accounting



(a) Labor wedges

Figure A.6 illustrates our counterfactual exercise in the GDR model economy without any quantity constraints – in comparison to Figure 4 – plotting the new counterfactual paths of GDR's GDP, consumption and hours worked per capita.

Figure A.6: Robustness, no quantity constraint: Counterfactual outcomes in the GDR



(a) GDP

(b) Consumption

(c) Labor

Table A.4 shows all consumption equivalent welfare measures for the GDR economy without quantity constraints. All changes in welfare measures compared to Tables 3 and 4 are due to the amount of consumption rationing. Except for the labor wedge counterfactual all of them increase in their negative or positive amount.

Table A.4: Robustness, no quantity constraints: Consumption equivalent welfare measures for the GDR

Counterfactual	Welfare measure in %				
	Δ^1	Δ^2	Δ^3	Δ^4	Δ^5
Zero residual	-11.99	-19.72	-19.64	-18.67	-18.58
No TFP growth	-40.84	-27.09	-27.12	-27.40	-27.44
TFP growth from FRG	34.97	13.09	13.15	13.91	13.98
Capital wedge from FRG	-0.02	-10.01	-9.90	-8.64	-8.53
Labor wedge from FRG	5.06	13.31	13.24	12.45	12.38

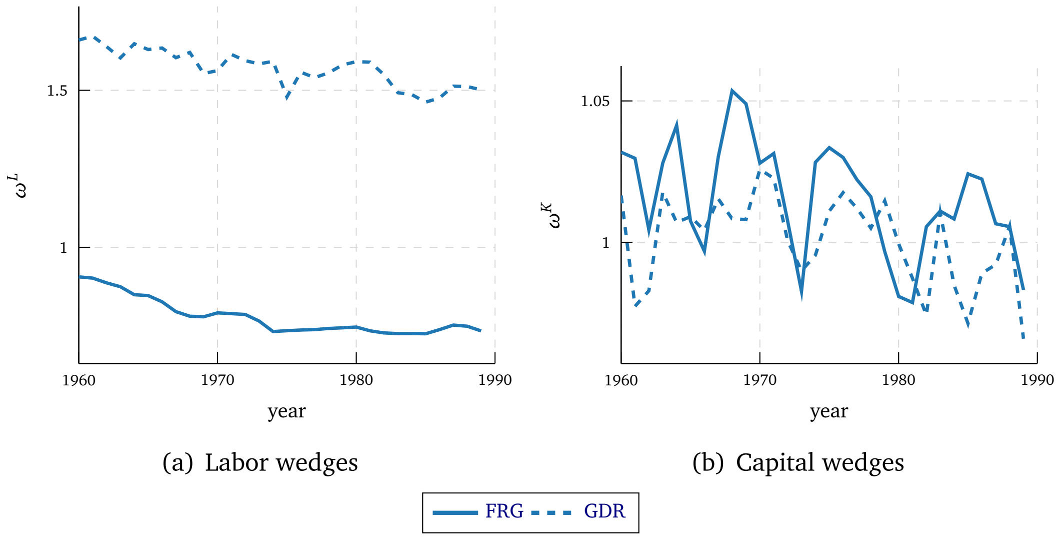
Notes: Δ^1 captures discounted total consumption equivalence until infinity (equation (10a)).Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)), Δ^3 captures discounted per capita consumption equivalence for the considered period ($N_{it} = 1,\ \forall t, i$), and Δ^4 captures non-discounted total consumption equivalence for the considered period ($\beta = 1 \forall i$), Δ^5 captures non-discounted per capita consumption equivalence for the considered period ($\beta_i = 1 = N_{it} = 1,\ \forall t, i$).

D.3 No government consumption in utility

This section presents the results from exercises where government consumption is disregarded in utility. More precisely, we use per-period utility function $u = \ln(c_{it}) + \theta_i \ln(\bar{l} - l_{it})$ instead of $u = \ln(c_{it} + g_{it}) + \theta_i \ln(\bar{l} - l_{it})$.

Figure A.7 illustrates the new labor and capital wedges for both Germanies as they are the only accounting wedges that change in comparison to those from Figure 3.

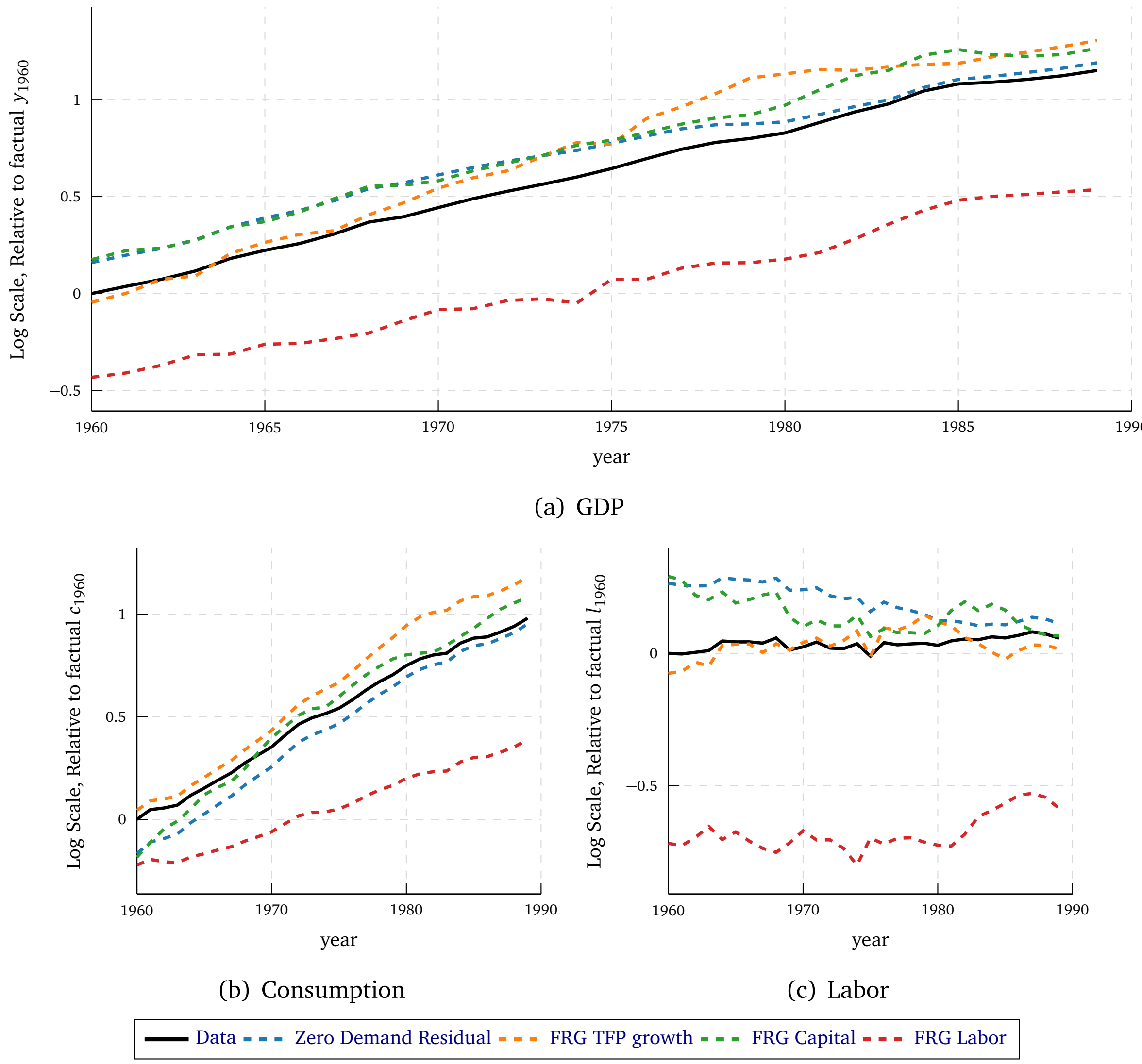
Figure A.7: Robustness, no government consumption in utility: Wedge accounting



(a) Labor wedges (b) Capital wedges

Figure A.6 illustrates our counterfactual exercise in the GDR model economy without government consumption in utility – in comparison to Figure 4 – plotting the new counterfactual paths of GDR's GDP, private consumption and hours worked per capita.

Figure A.8: Robustness, no government consumption in utility: Counterfactual outcomes in the GDR



(a) GDP

(b) Consumption

(c) Labor

Table A.5 shows all consumption equivalent welfare measures compared to Tables 3 and 4.

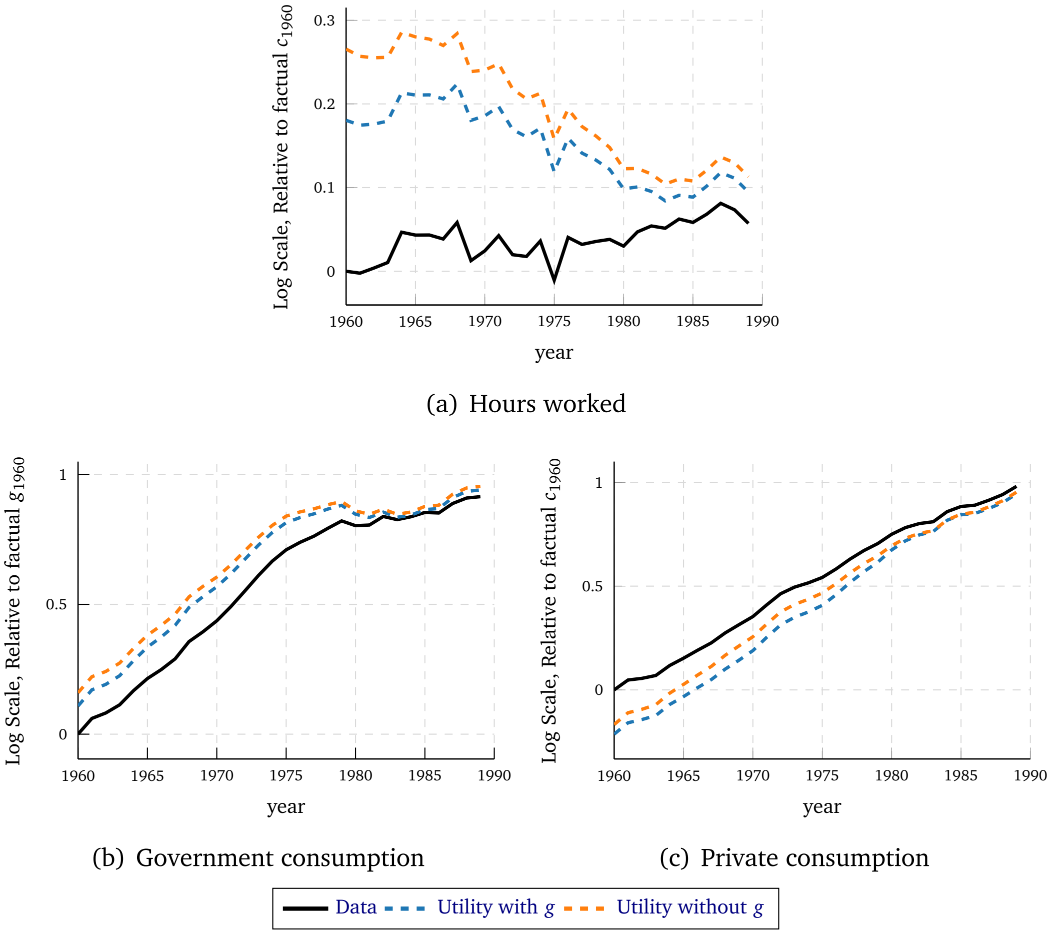
Table A.5: Robustness, no government consumption in utility: Consumption equivalent welfare measures for the GDR

Counterfactual	Welfare measure in %				
	Δ^1	Δ^2	Δ^3	Δ^4	Δ^5
Zero residual	-20.67	-32.66	-32.52	-30.99	-30.85
No TFP growth	-39.56	-23.18	-23.15	-22.75	-22.72
TFP growth from FRG	33.72	13.21	13.26	13.96	14.02
Capital wedge from FRG	-1.56	-18.90	-18.75	-16.99	-16.84
Labor wedge from FRG	24.13	42.34	42.16	40.06	39.88

Notes: Δ^1 captures discounted total consumption equivalence until infinity (equation (10a)).Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)), Δ^3 captures discounted per capita consumption equivalence for the considered period ($N_{it} = 1, \forall t, i$), and Δ^4 captures non-discounted total consumption equivalence for the considered period ($\beta = 1 \forall i$), Δ^5 captures non-discounted per capita consumption equivalence for the considered period ($\beta_i = 1 = N_{it} = 1, \forall t, i$).

Figure A.9 compares the paths of governmental g and private consumption c and hours worked l from the baseline model with g in utility to the model without g in utility given the zero demand counterfactual. Keep in mind that leisure is $\bar{l} - l$.

Figure A.9: Robustness, Zero demand counterfactual in the GDR



(a) Hours worked

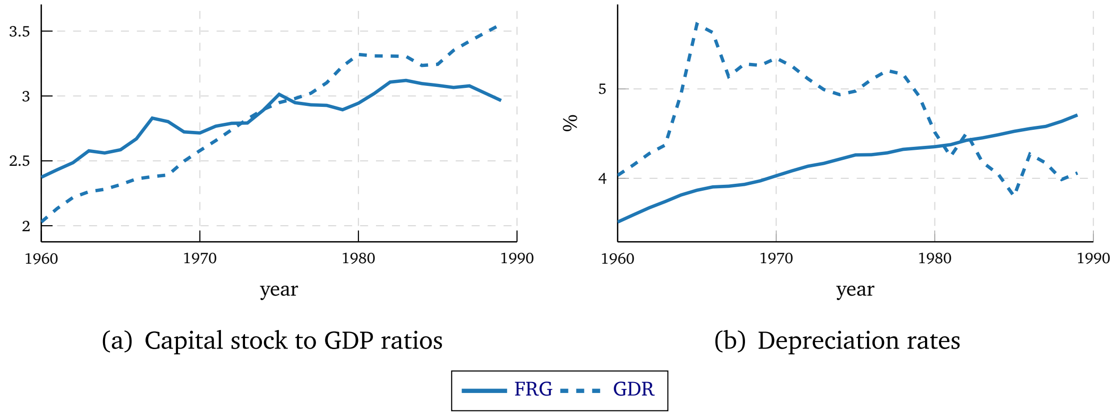
(b) Government consumption

(c) Private consumption

D.4 Other capital input measure

This section shows the results implied by the usage of different capital input measures we discuss in our robustness checks. Net fixed assets correspond to approximately 71 % of gross fixed assets in 1990 in the GDR and 64 % in 1991 in the FRG. Applying the perpetual inventory method backward, accordingly, the initial capital stocks using net fixed assets correspond to approximately 31 % in the GDR and 36 % in the FRG of their initial capital stocks from gross fixed assets. Figure A.10 illustrates the changes of our data – in comparison to Figure 1 – plotting the new capital-to-GDP ratios and depreciation rates.

Figure A.10: Robustness, net fixed assets: Data

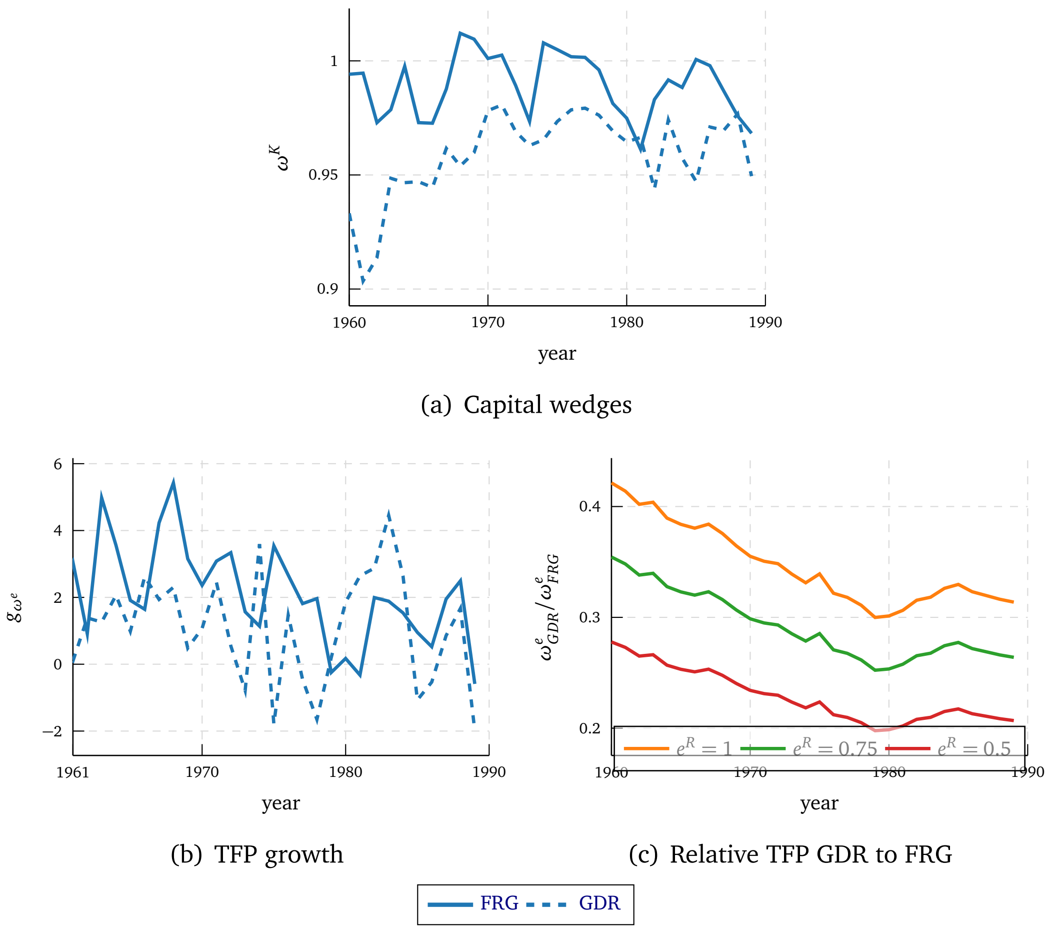


(a) Capital stock to GDP ratios

(b) Depreciation rates

Figure A.11 illustrates the accounting wedges– in comparison to Figure 3 – plotting the new capital wedges as well as TFP growth and relative TFP levels.

Figure A.11: Robustness, net fixed assets: Wedge accounting



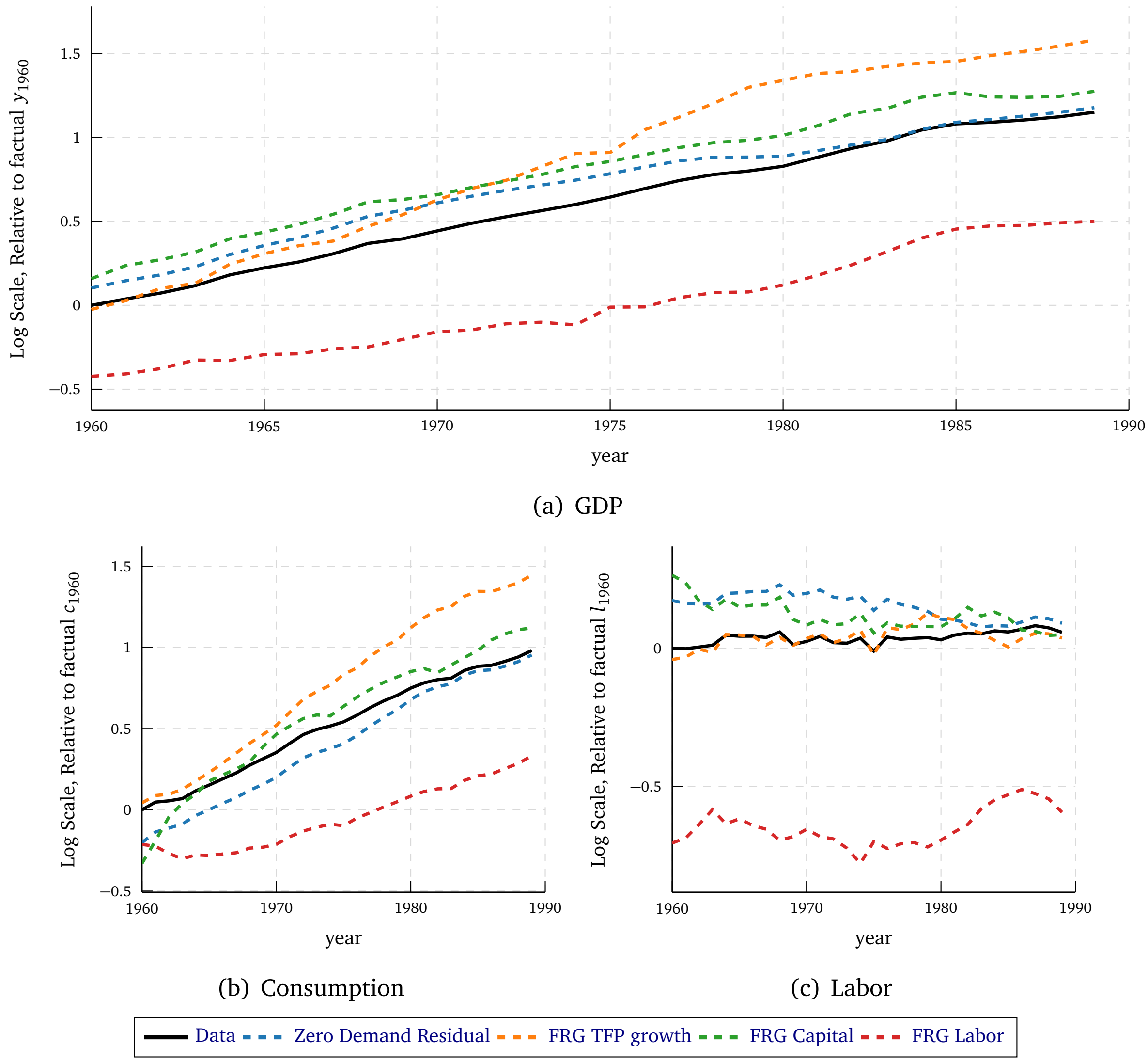
(a) Capital wedges

(b) TFP growth

(c) Relative TFP GDR to FRG

Figure A.12 illustrates our counterfactual exercise – in comparison to Figure 4 – plotting the new counterfactual paths of GDP, consumption and hours worked per capita.

Figure A.12: Robustness, net fixed assets: Counterfactual outcomes in the GDR



(a) GDP

(b) Consumption

(c) Labor

Table A.6 shows all consumption–equivalent welfare measures for the GDR using net fixed assets as capital input instead of gross fixed assets. All welfare measures are reduced compared to Tables 3 and 4.

Table A.6: Robustness, net fixed assets: Consumption equivalent welfare measures for the GDR

Counterfactual	Welfare measure in %				
	Δ^1	Δ^2	Δ^3	Δ^4	Δ^5
Zero residual	-14.15	-22.83	-22.74	-21.67	-21.56
No TFP growth	-14.42	-13.85	-13.92	-14.64	-14.71
TFP growth from FRG	66.71	26.86	27.06	29.34	29.55
Capital wedge from FRG	1.57	-6.00	-5.85	-4.11	-3.97
Labor wedge from FRG	16.16	22.99	22.85	21.33	21.20

Notes: Δ^1 captures discounted total consumption equivalence until infinity (equation (10a)).Δ^2 captures discounted total consumption equivalence for the considered period (equation (10b)), Δ^3 captures discounted per capita consumption equivalence for the considered period ($N_{it} = 1,\ \forall t, i$), and Δ^4 captures non-discounted total consumption equivalence for the considered period ($\beta = 1 \forall i$), Δ^5 captures non-discounted per capita consumption equivalence for the considered period ($\beta_i = 1 = N_{it} = 1,\ \forall t, i$).

E Additional Figures

Figure A.13: Unemployment adjusted hours worked