Productivity Growth and Class Struggle in a Growth Regime Framework

A Proposal for a Varieties of Productivity Regimes Approach Applied to Germany and the US from 1991–2022

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EPOG+

Abstract

Scrutinizing post-Keynesian theory of endogenous technical change and Régulation Theory, this paper examines productivity growth and its variation within capitalist economies. It aims to identify how institutions steer productivity growth. The study concludes that they not only have a direct impact on the innovative environment, but also affect productivity by changing wages and demand. The derived analytical framework distinguishes between these direct and indirect effects. Applying this method to Germany and the US from 1991 to 2022, the study claims that in Germany there is a labor-led productivity regime within the export-led growth regime and in the US there is a state-led productivity regime within the debt-led growth regime. This explains Germany's more substantial decline in productivity growth due to changes in the wage-labor nexus compared to the US. There, public investment stabilizes productivity growth.

JEL codes: E11, O43, O47, P52

Keywords: Endogenous technical change, growth regimes, institutions, Kaleckian models, Régulation Theory, Germany, US

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1 Introduction

Stagnation tendencies of capitalism after the Golden Age do not stop at labor productivity (Storm, 2022). This decline puts pressure on policy makers. After the far-reaching orientation towards finance in the 1980-90s, productivity developed into a crucial topic in the decade after the global financial crisis (GFC) in 2007-8. It seems that the traditional capitalist world has different approaches to this realm and, at least in comparison to Europe, it seems that the US is winning this 'innovation race' (Eichengreen, 2024). Indeed, the US consistently shows growth on a higher level than, for example, Germany (OECD, 2024d). However, productivity growth rates are overall declining across OECD countries (Hartwig, 2014).

Theoretically, technological progress is arguably the central narrative of capitalism. All modern economic theories deal with it, all of them place it at a crucial point – the main difference is *where* they place it. Early neoclassical theory takes technology as a prerequisite defining the growth process (Solow, 1956) while later work claim to 'endogenize' it as inter-temporal optimization problem (Romer, 1990). Post-Keynesian research from early on considers technological change as outcome of growth dynamics (Kaldor, 1957, 1961, 1966; Oughton & Tobin, 2023). Marxian theory adds the notion of class struggle to this picture.

This is the point of departure for the following work. Based on post-Keynesian theories of endogenous technical change and the institutional ideas of Régulation Theory, we will propose a strategy to analyze the institutional drivers of productivity and identify channels through which social relations and distributional conflict affect productivity growth. The unique contribution of this paper is to incorporate these channels in a growth regime framework and derive specific productivity regimes exploitable for comparative political economy (CPE). We will apply this framework to Germany and the US between 1991 and 2022 as archetypes of liberal and coordinated market economies. Thus, the research question is twofold: *First, how can productivity growth be implemented in the growth regime framework? Second, what productivity regime do Germany and the US have in the period from 1991 to 2022?*

This research can build on a vast amount of literature. Current generations of scholars grasp the notion of endogenous technical change in neo-Kaldorian cumulative causation models (Setterfield & Cornwall, 2002) or by adding technical change to the Bhaduri and Marglin (1990) model with the Verdoorn relationship and a wage-push effect (Naastepad, 2006; Hein & Taras-

sow, 2010). Herein, the idea that institutions shape economic development is by no means contradicted, but it remains an underlying narrative. Explicitly, Vergeer and Kleinknecht (Vergeer & Kleinknecht, 2010, 2014; Kleinknecht et al., 2014; Kleinknecht, 2020) but also Storm and Naastepad (Storm & Naastepad, 2012; Storm, 2022) observe the stagnation in productivity growth from an institutional view. However, these studies do not build a theoretical framework of analyzing institutions in this context. They simply add respective variables to the previous models. This is where Régulation Theory comes into play. While scrutinizing Marxist and Kaleckian ideas in line with the post-Keynesian theory presented here, it further offers an approach to analyze capitalist structures, its varieties and changes (Boyer, 2002). In Régulation Theory institutional forms define the structure of the economy and therefore also productivity. The emphasis on the interplay between the accumulation regime and the mode of regulation underscores social relations in shaping economic dynamics more evidently than post-Keynesians do (Hein et al., 2015). Mostly used in examining the historical sequence of growth regimes, the Régulation approach can also be adjusted to analyze the different models of development of economies within the same historical period (Jessop, 1997).

From post-Keynesian perspective, CPE is subject to benevolent critique (Hein, 2023b). While some authors rely on supply side theory and others misunderstand heterodox ones, post-Keynesian economics is generally open to connect its theory of demand and growth regime with the political economy view. However, current growth regime research does not classify existing regimes in terms of their attitude to productivity growth, although there are various theoretical findings on this topic. Scholars do raise the issue of technological change in the context of the growth regime debate. Analyzing the effect of the productivity regime on employment (Hein, 2023b) and path dependency of growth trajectories (Stockhammer, 2022) are key. However, there is yet no unified institutional framework of a productivity regime combining the demand and supply side and going beyond their pure dichotomy. To investigate the possibility of such an approach, is the overarching exploratory theme of this work.

The remainder of this paper is structured as follows. Section 2 draws the big picture of productivity growth in Germany and the US to introduce the realm in which we operate in this paper and show the diverse developments in developed countries. In Section 3 we connect post-Keynesian theories of technical change with the notion of institutional forms put forward by Régulation Theory and build our theoretical model to derive different productivity regimes.

Turning back to Germany and the US, section 4 applies the model to both economies and classifies their specific productivity regime. Section 5 concludes.

2 Declining Productivity Growth in Germany and the US

Germany and the US are two common case studies. Scholars scrutinize both countries as prototypes for coordinated market economies (CMEs) and liberal market economies (LMEs) in the vein of the Varieties of Capitalism (VoC) approach by Hall and Soskice (2001). While LMEs are characterized by flexible labor markets, limited influence of trade unions, deregulated market-oriented financial systems, and low emphasis on public services, CMEs have more organized labor markets, high relevance of trade unions, regulated bank-based financial systems and a sizable public service provision (Hein, 2023b). We will focus on the period from 1991 to 2022 as the most recent era of the two economies exhibiting various crises with different intensities - most prominently the GFC with its fundamental character and the associated changes in the political economy. German reunification in 1990 puts a limit to the observable period.

Figure 2.1 shows the productivity growth of Germany and the US for the given period[1]. Over the whole period the US shows higher productivity growth (1.61%) than Germany (1.22%). Before the GFC, both economies exhibit higher productivity growth rates than after. Thus, the big picture is a decline in productivity growth as a trend that affects both economies - and OECD countries in general (Hartwig, 2014). Nevertheless, Germany still appears to have a more rapid decrease than the US on a lower level. After the GFC, its productivity grows by 0.77% on average while the US are better able to cushion the decline in rates, remaining at an average of 1.22%. This cannot be traced back to a global trend alone and indicates a need to examine the differences in these two economies.

Meanwhile, the US outperform Germany consistently in all output-related macroeconomic variables. As depicted in Figure 2.2, real GDP and real GDP per capita are not only on a higher level in the US but also grow faster. In 23 out of 32 years observed, the GDP growth in the US is higher than in Germany. On average, it is twice as high in the US (3.13%) before the GFC as in Germany (1.39%). Even with a more pronounced decrease in the US after the GFC, it remains higher than in Germany in the post-GFC period.

Obviously, productivity and output growth are strongly connected. Lower productivity growth

[1] For more information on all the data used and related calculations, see Appendix.

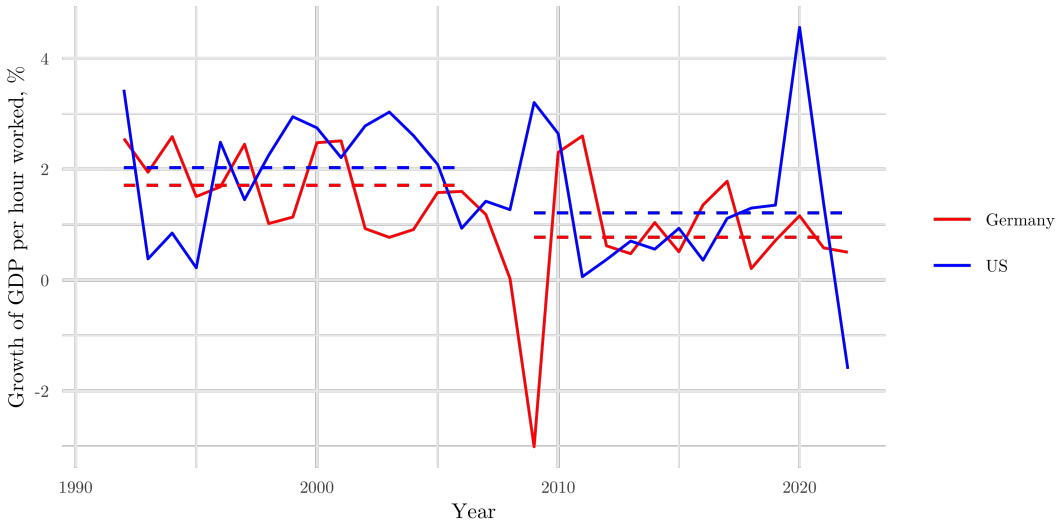
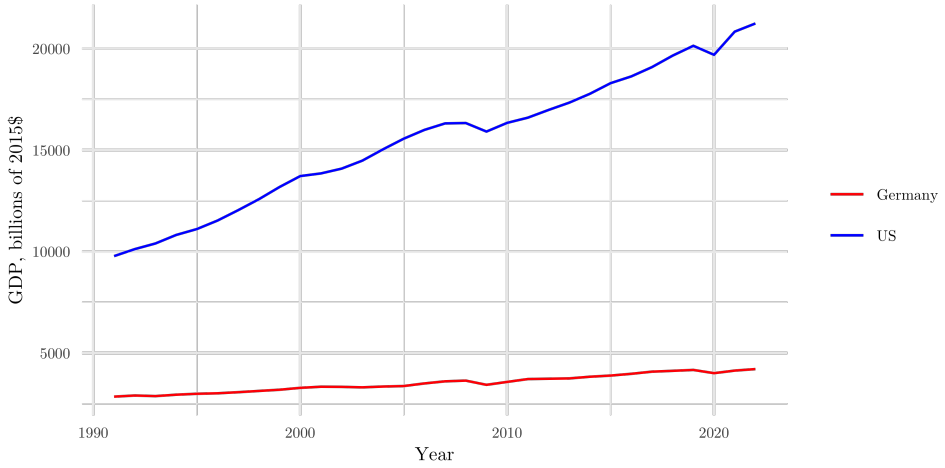


Figure 2.1: Productivity growth, Germany and the US, %, 1992–2022
Notes: Own calculation and depiction; data from OECD (2024d). Dashed lines depict averages - and post-GFC. Pre-GFC: 1992–2006; post-GFC: 2009–2022.

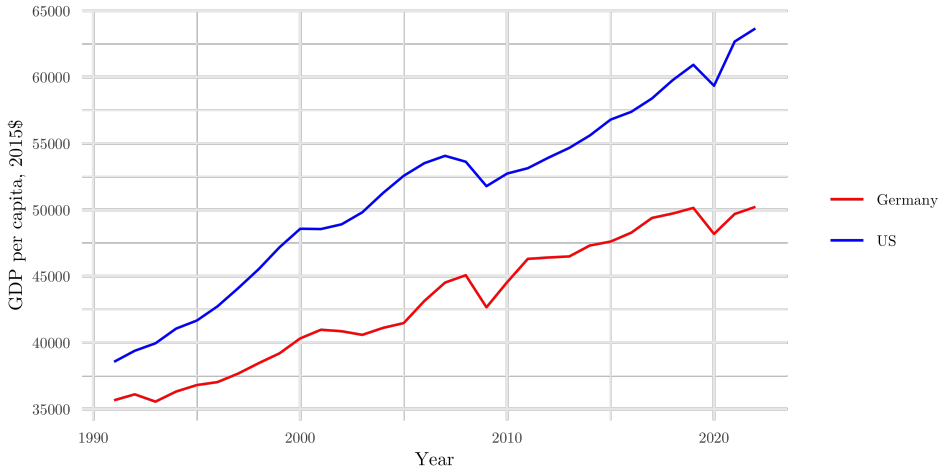
restricts the growth of output while output growth also affects productivity. Thus, declining productivity growth and output growth go hand in hand and build a vicious cycle of secular stagnation driven by demand (Storm, 2022). This downward spiral seems to be more pronounced in Germany than the US. We now set out to find a theoretical framework that explains these variations between both economies.

3 Institutions' Effects on Productivity Growth

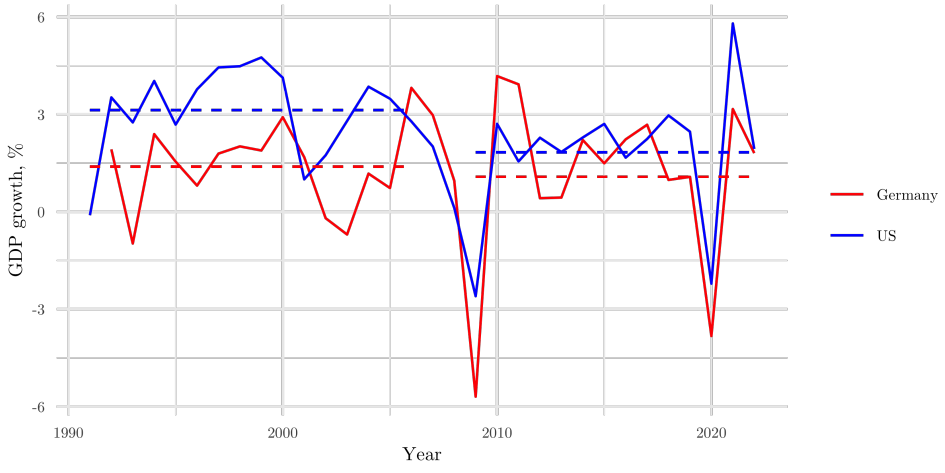
Understanding productivity and its growth as outcome of economic dynamics, post-Keynesian theory explains which macroeconomic factors affect productivity. In the following, we extend the underlying stance towards institutions with the more sophisticated framework of Régulation Theory. Before, some words on terminology are needed. Most broadly, technical change and progress are used to grasp the social development regarding technology and its implementation. Although technical progress sounds more optimistic and technical change remains more neutral, we use the terms synonymously. Meanwhile, technology and innovation refer to the actual invention of knowledge and methods. They are not necessarily implemented but rather form a range of possibilities. Productivity growth – the main theme in this work – encompasses the actual increases in efficiency following technical change measured as macroeconomic variable.



(a) Output, billions of 2015$



(b) Output per capita, 2015$



(c) Output growth, %

Figure 2.2: Output-related macroeconomic variables, Germany and the US, 1991–2022
Notes: Own depiction; data from European Commission (2023) and OECD (2024c). Own calculation of growth rate and averages. Dashed lines depict averages pre- and post-GFC. Pre-GFC: 1991–2006; post-GFC: 2009-2022.

3.1 A Post-Keynesian Model of Endogenous Technical Change

Considering technical change as endogenous to growth dynamics has a history in post-Keynesian research. Kaldorian growth theories from early on promote different approaches to include technical progress in the analysis of macroeconomic growth processes: While Kaldor (1957, 1961) states a positive relationship between capital growth and productivity growth in a technical progress function (TPF), Kaldor (1966) implements Verdoorn's law describing a positive effect of output growth on productivity growth. Robinson (1962, ch. 2) emphasizes the relevance of historical time in the analysis of technical progress, what implies irrevocable processes (Gallo & Setterfield, 2023). Technical progress becomes path-dependent and an outcomes of dynamics within a political-economic system (Oughton & Tobin, 2023). These systems are, in particular in Kaleckian theory, characterized by class struggle and power (Kalecki, 1943). Thus, drawing on classical approaches as well as the Kaleckian tradition of taking distribution as prerequisite to the model, distribution also distinctively affects technical progress (Tavani & Zamparelli, 2018; Kemp-Benedict, 2022). These two aspects – demand and distribution – lay the theoretical foundation of the productivity regimes.

Post-Keynesian research mainly concerns labor productivity growth. It rejects the concept of capital productivity succeeding the insights of the capital controversy. Building on Rowthorn (1981), most scholars assume Harrod-neutral technical progress i.e., it is labor-saving and capital-embodied. The capital-output ratio remains constant (see e.g., Hein, 2014, ch. 8) what is, according to Kaldor (1985, ch. 3), one of the best established stylized facts of modern capitalism. We will follow this assumption.

3.1.1 The Demand Regime

The well-known Verdoorn's law proposed in Kaldor (1966) represents the empirical counterpart of the TPF (McCombie & Spreafico, 2016). Verdoorn's law describes the effect of output growth on productivity growth due to increasing returns to scale in manufacturing i.e., learning-by-doing and teh division of labor (Verdoorn, 2002; McCombie, 2016). Following the fundamental post-Keynesian insight that effective demand determines the level of output, technical progress is demand-led. Thus, not only short-run but also long-run equilibria are subject to the principle of effective demand. Demand shocks can trigger changes in equilibria. Respective dynamics can be characterized as circular process where "technical progress is both the cause

and the result of economic growth" (Rowthorn, 1981, p. 26). Neo-Kaldorian approaches scrutinize these mechanisms to analyze growth processes. Most prominent, Setterfield and Cornwall (2002) define two fundamentals in this tradition: Demand determines the actual rate of growth and the potential rate of growth.

Exports as prominent trigger in the proposal by Kaldor (1985) display only one component of the income-independent part of demand. More generally, Nah and Lavoie (2019) incorporate the idea of a productivity regime in a Kaleckian model with an autonomous consumption element but without a public sector. Thus, the authors incorporate a Sraffian supermultiplier mechanism in this model of endogenous technical change. Herein, they show that changes in the growth rate of autonomous consumption increase the rate of accumulation and the growth rate of productivity in the medium and the long run. Deleidi et al. (2023) argue that changes in governmental expenditure as part of autonomous demand produce even larger effects on productivity growth than exports. Therefore, they bring back the state to the picture.

One important limit of this demand effect is the sectoral structure. Originating from analysis of manufacturing in Kaldor (1966), Verdoorn's law can only to a certain degree be extended to the whole economy. Magacho and McCombie (2020) show that sectors can differ significantly regarding their respective Verdoorn coefficients. This shows especially importance in the context of declining industrial shares in most developed economies.

Nevertheless, we can integrate a general demand effect on productivity in our economic model. Advancing the Bhaduri and Marglin (1990) model with its wage- and profit-led demand regime, Setterfield and Cornwall (2002) extend this logic to a demand and productivity regime. Following Hein and Tarassow (2010) and Hein (2014, ch. 8), we formalize our post-Keynesian model of endogenous technical change as follows.

The goods market equilibrium for the open economy without a state[2] requires that planned saving (S) equals net investment (pI) plus net exports (NX):

$$S = pI + NX \tag{1}$$

Normalizing this by the nominal capital stock (pK), shows that the saving rate (σ) equals the

[2] State activity will, therefore, later be understood as an increase in the demand regime through the autonomous component.

accumulation rate (g) and the net export rate (b):

$$\sigma = g + b \tag{2}$$

The saving rate can be differentiated in the saving rate out of profits (S_Π) and out of wages (S_W). The propensity to save out of profits is higher than out of wages. We insert the connection of profits with domestic income for the profit share ($h = \Pi/(W+\Pi) = \Pi/PY$) and the definition of the capacity utilization as output to potential output ($u = Y/Y^p$) and receive:

$$\sigma = \frac{S_\Pi + S_W}{pK} = \frac{s_\Pi \Pi + s_W(Y-\Pi)}{pK} = [s_W + (s_\Pi - s_W)h]\frac{u}{v}, \quad 0 \leq s_W < s_\Pi \leq 1 \tag{3}$$

The investment function contains the profit share besides a parameter for animal spirits and the rate of capacity utilization as indicator for expected demand. Because technical progress is capital-embodied, it will stimulate investment. Thus, the investment rate is:

$$g = \alpha + \beta u + \tau h + \omega \hat{y}, \quad \beta, \tau, \omega > 0 \tag{4}$$

To derive the stability condition for the goods market equilibrium, we define the behavior of the net export rate. Assuming the Marshall-Lerner condition, the net export rate depends positively on international competitiveness. Thus, real exchange rate (e^r) increases raise net exports. Furthermore, the relative development of domestic and foreign demand affects net export. A faster increase in domestic than in foreign demand lowers net exports. Using capacity utilization as a proxy for this relationship and assuming a positive connection between the profit share and international competitiveness, we receive the following equation for the net exports rate:

$$b = \psi e^r - \phi u, \quad \psi, \phi > 0 \tag{5}$$

Ultimately, the condition for a stable equilibrium is a higher elasticity of savings to capacity utilization than of investment and net exports together:

$$\frac{\delta\sigma}{\delta u} - \frac{\delta g}{\delta u} - \frac{\delta b}{\delta u} > 0 \Longrightarrow [s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi > 0 \tag{6}$$

Finally, the goods market equilibrium itself displays in terms of capacity utilization and capital accumulation as:

$$u^* = \frac{\alpha + \tau h + \omega\hat{y} + \psi e^r(h)}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi} \tag{7a}$$

$$g^* = \frac{\left\{[s_W + (s_\Pi - s_W)h]\frac{1}{v} + \phi\right\}(\alpha + \tau h + \omega\hat{y}) + \beta\psi e^r(h)}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi} \tag{7b}$$

We use these goods market equilibria as definition of the demand regime.

3.1.2 The Productivity Regime

The notion of wage-pushed technical change that already can be found in Marx (1975, ch. 15) later picked up by Hicks (1963) bases on the importance of profits for capitalists. These approaches center strategies to ensure profitability in their theory of technical progress. Rising costs pressure capitalists and lead to the adaption of cost-reducing methods. Related to wages, rising labor costs induce the use of labor-saving methods i.e., labor productivity growth. Following these arguments, post-Keynesians in Kaleckian tradition acknowledge distribution effects on technical change (Cassetti, 2003; Naastepad, 2006; Hein & Tarassow, 2010; Hartwig, 2014). They use models in the tradition of Bhaduri and Marglin (1990) with a profit variable in the investment function and include the wage or vice versa the profit share in equations for productivity growth.

Thus, we scrutinize the demand and wage channel to define the productivity regime. Productivity growth depends on an autonomous processes of innovation (η), positively on output growth due to the Verdoorn relationship (ρ) and negatively on the profit share because of the Marx-Hicks effect (θ). Similarly, ϵ captures the positive connection between capital accumulation and productivity growth in Kaldor's TPF. Again following Hein and Tarassow (2010), we formally define the productivity regime respectively for capacity utilization and capital accumulation as:

$$\hat{y} = \eta + \rho u - \theta h, \quad \eta, \rho, \theta > 0 \tag{8a}$$

$$\hat{y} = \eta + \epsilon g - \theta h, \quad \eta, \epsilon, \theta > 0 \tag{8b}$$

The overall long-run equilibrium of the demand and productivity regime results from the mutual insertion of Equation 7a and Equation 8a. The result for capacity utilization and productivity growth is:

$$u^{**} = \frac{\alpha + (\tau - \theta\omega)h + \psi e^r(h) + \omega\eta}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \tag{9}$$

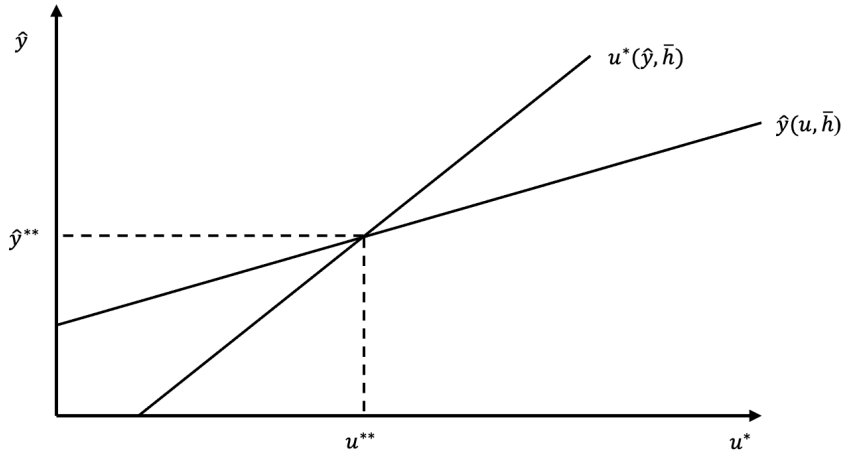
$$\hat{y}^{**} = \frac{(\eta - \theta h)\left\{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi\right\} + \rho[\alpha + \tau h + \psi e^r(h)])}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \tag{10}$$

Inserting these two equilibrium values in Equation 4 results in an equilibrium rate of capital accumulation:

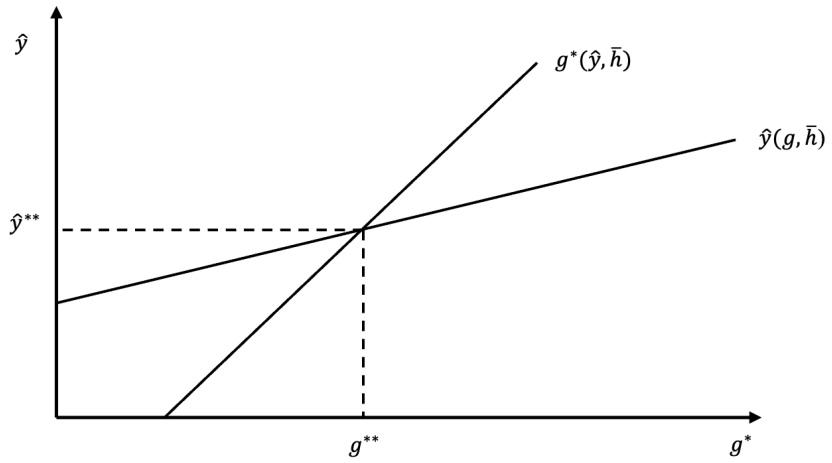
$$\begin{aligned} g^{**} = \alpha + \tau h + \beta & \left\{ \frac{\alpha + (\tau - \theta\omega)h + \psi e^r(h) + \omega\eta}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \right\} \\ + \omega & \left\{ \frac{(\eta - \theta h)\left\{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi\right\} + \rho[\alpha + \tau h + \psi e^r(h)]}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \right\} \end{aligned} \tag{11}$$

Formally, the effect of changes in distribution can be grasped with taking the derivatives of the overall long-run equilibrium provided in the Appendix. Graphically, this post-Keynesian model of endogenous technical change can be depicted as in Figure 3.1.

The method to determine the direction of the effect by Cassetti (2003), Naastepad (2006), and Hein and Tarassow (2010) develops twofold: First, taking productivity growth as an exogenous factor, the demand regime is determined by the effects of its components like shown in Equation 7a and Equation 7b. Depending on the strength of the respective channel, the demand regime is, again, either wage- or profit-led. Second, in turn taking the demand regime as exogenous, its effect through the Verdoorn coefficient and the wage channel on productivity growth is analyzed



(a) Capacity utilization and productivity growth



(b) Capital accumulation and productivity growth

Figure 3.1: Long-run equilibrium of the demand and the productivity regime
Source: Own depiction based on Hein (2014, ch. 8).

as depicted in Equation 8a. Regardless of the character of the demand regime, the productivity regime is distinctively wage-led through the wage channel. Therefore, in case of a wage-led demand regime the overall regime must be contractive in case of a rising profit share. However, Hein and Tarassow (2010) show that, nevertheless, there can exist a contractive, intermediate and expansive overall regime for profit-led demand regimes and distributional changes.

3.2 Identifying Institutions in the Model

Even when not addressing the topic directly, post-Keynesian research acknowledges the crucial role of institutions. Nevertheless, some scholars see the need to explicitly include institutional topics. We will elaborate on them below. However, there is not yet a unified framework to ana-

lyze the effects of institutions on productivity growth. While showing great similarities with the post-Keynesian approach relaying on the same foundations of Kaldorian and Kaleckian macroeconomics, the crucial role of institutions Hein et al. (2015) and the approach of using demand and productivity regimes (Amable, 2002; Boyer, 1988), Régulation Theory can help to provide an institutional framework i.e., its 'institutional forms'. Thus, we can easily bring together the workhorse model of post-Keynesianism with the institutional framework of Régulation Theory to fruitfully forge ahead the analysis of productivity regimes.

3.2.1 Some Institutional Topics in Heterodox Research

Vergeer and Kleinknecht (e.g., Vergeer & Kleinknecht, 2010, 2014; Kleinknecht et al., 2014; Kleinknecht, 2015, 2020) but also Storm and Naastepad (e.g., Storm & Naastepad, 2012; Storm, 2022) explain the observation of stagnant productivity growth with a switch from demand-side to supply-side economics. Supply-side labor market reforms with a focus on flexibility harm innovation and, consequently, productivity growth in various ways: Labor market flexibilization weakens knowledge management, particularly in Mark II firms, by reducing firm-specific training and learning-by-doing due to shorter job tenure. Quicker employee turnover lowers worker loyalty and undermines insider positions that protect valuable knowledge. This discourages specialization, essential for a productive division of labor. As a result, flexibilization negatively impacts innovation and productivity (Kleinknecht, 2020). Put differently, Palley (2012) builds on Dutt (2006) to argue that labor market tightness incentivices firms to innovate and introduce labor-saving technology in similar manner as higher wages[3].

Building upon a Schumpeterian innovation model, Kleinknecht (2020) elaborates on the difference of Mark I and Mark II firms. While many small firms and an outstanding role of new entrepreneurs for innovation characterize the former, large Mark II firms establish R&D departments to foster innovation[4]. While this leaves research with a complex picture of institutional effects, some scholars strive for a simple approach to include them. Storm and Naastepad (2012, ch. 4) proceed in a straightforward manner and distinguish a distinct labor market channel from the wage channel. Hence, they consider a direct effect on productivity growth.

The state herein only has an indirect influence on productivity growth by shaping the labor

[3] For more literature in this research strand, see Tavani and Zamparelli (2018, p. 147).
[4] For a more detailed differentiation, see Malerba and Orsenigo (1995).

market. However, it can have a direct effect, too. Widely discussed in public economic debate in the context of industrial policy, the 'entrepreneurial state' could be a crucial agent to push for innovation breakthroughs needed for economic challenges (Mazzucato, 2011). Strongly connected to this is the narrative of a mission-oriented economy. Herein, the state systematically implements public policies that rely on cutting-edge knowledge to achieve specific goals related to the defined challenge (Mazzucato, 2018). Exploiting the demand channel mentioned above, Deleidi and Mazzucato (2019) argue that such a policy approach can result in an 'innovation cascade' – a virtuous circles arising from state intervention.

Competition and monopolistic tendencies pose a further factor for innovation. Robinson (1969) argues that patents decrease the diffusion of innovation and therefore the speed of technical progress (Oughton & Tobin, 2023). Contemporarily, the literature about 'intellectual monopoly capitalism' deals with these dispositions in context of financialization (Pagano, 2014). Representing a new tendency in the dominance of finance over production, monopolistic firms prioritize rent-seeking over proper innovation, which was intended to be the core of the patent system (Durand, 2020). While stretching beyond the scope of this paper, this is especially relevant for the case of big tech companies and their influence on knowledge appropriation as shown in Rikap (2021). As pointed out by Rikap (2023), this does not fundamentally alter capitalism but changes the way of accumulation. The patent system can be an indicator for either the orientation of firms towards rent-seeking or towards accumulation through innovation (Durand, 2020).

Ultimately, there are various institutional arguments present in heterodox research on productivity growth. However, they yet lack a common taxonomy in the macroeconomic context. Régulation Theory provides exactly this.

3.2.2 Régulation Theory's Contributions

Régulation Theory building on the work of Aglietta (2015) centers the social prerequisites of economic production, reproduction and their interaction. The main argument is that the social sphere must be *regulated*[5] in a certain way so it fits to the mode of production. The main theme of Régulation Theory is threefold: to show that capitalist reproduction needs a form of

[5] Regulation in this sense is broader than the usual understanding of regulation as optimization of the market by the state. This linguistic confusion is a main source of misunderstanding of Régulation Theory (Boyer, 2002). Therefore, in this work the term 'régulation' in its French spelling is used.

régulation; to analyze why and how existing contradictions in society can be bridged in a certain time period; and to conclude what the reasons for the end of such a stable time period are and why crises emerge.

As Boyer (2002) points out, the analysis of the historical diversity in the institutional frameworks shaping capitalist economies represents the main concern for Régulation Theory. Over time, series of disequilibria and conflicts within economies shape their economic development and destabilize them. A loss of institutional coherence leads to crisis (Amable, 2002). Regime *change* over time through crises is the pivotal point of Régulation Theory. However, this focus on episodes of capitalism is not the sole object of research. The approach was broadened to include further regimes and periods beyond Fordism (Jessop, 1997) and, as Amable (2023) points out with respect to the 'growth model perspective' following Baccaro and Pontusson (2018), contributed to the research of growth regimes and is compatible with the analysis of their variations.

Building on a Marxist reproduction schema (Boyer, 2002) and extending Kaleckian macroeconomics (Boyer, 1988), Régulation Theory unravels the notion of institutional arrangements that affects the growth paths of economies (Juillard, 2002). Therefore, it is better suited to add institutional nuances to models of endogenous technical change than the popular VoC approach. While the VoC literature bases its macroeconomics on New Consensus theory and only confirms the prevalent regime, Régulation Theory is concerned with their development and shifts while focusing the interaction of distribution, demand and, ultimately, technical progress rather than centering the supply side conditions of different economies.

A certain growth regime in Régulation Theory builds on technology, production organization and institutions in conjunction (Amable, 2002). Analyzing the institutional context is crucial for comprehending how technical change among other factors reshape production processes and markets, both driving these structural transformations and being shaped by them (Petit, 1999). Régulation Theory calls these conditions the *mode of regulation*. This notion entails all the individual and collective behaviors under a specific regime that reproduce its social relations, support the accumulation regime, and guarantee its consensus with the social relations (Amable, 2023). Herein, social relations can be described along various dimensions, namely the *institutional forms* that go beyond the narrow definition of institutions as state institutions but encompasses them as *social* institutions. Scholars summarize them under five categories (see

e.g., Boyer & Saillard, 2002; Amable, 2023): First, the monetary form portrays the social design of money as general equivalent in the respective historical situation; second, the wage-labor nexus depicts the relations between capital and labor and its conflicts about work organization, conditions and reproduction of the wage earners; third, the forms of competition elucidate how producers' relationships are structured; fourth, the international regime places an economy in the international order; fifth and lastly, the forms of the state show how the state apparatus is integrated in the economic process. The interplay of these institutional forms in the mode of regulation manifest themselves in an accumulation regime (Juillard, 2002).

There are different understandings of the importance of certain institutional forms. Boyer (2000) suggests that every historical period with its respective accumulation regime shows an unique hierarchy of the institutional forms. One form dominates and the other areas of conflict adjust accordingly. If it was the wage-labor nexus in the post-war period, it is nowadays clearly the forms of competition due to increased internationalization that dominates (Durand & Keucheyan, 2015). Nevertheless, scholars highlight the wage-labor nexus as most relevant in the concrete context of growth regimes and productivity gains (Petit, 1999). Thus, the focus on technical progress requires analysis of several institutional forms in conjunction and the shifts in their hierarchy, not only the wage-labor nexus itself.

The most relevant institutional form in this context is the wage-labor nexus. As the socio-technical regime, that signify the institutional governance towards technology, sketches the general development of the organization of labor (Leborgne & Lipietz, 1988), the relationship between capitalists and workers, how they jointly organize production and resolve conflict is crucial. Boyer (1988) defines five elements: First, the means of production and control over workers; second, the division of labor and its impact on skills; third, employment stability; fourth, wage determinants and state welfare; fifth, the standard of living for wage earners.

Furthermore, as innovation in the Marxist tradition of Régulation Theory opens the possibilities for firms to potentially increase profits – i.e. 'relative value creation' – competition is crucial in the context of productivity growth (Boyer, 1988). Despite the criticized dependency of profits on productivity in some strands of Marxist theory (e.g., by Herr, 2019), the notion of a connection between competition and productivity is broadly accepted. Primarily, this is examined through a Schumpeterian lens, encapsulated by the term 'creative destruction'. In the Régulation context, Juillard and Boyer (1992) stress the relevance of inter-capitalist competition over demand shares

and the related distribution of technology. As perfect markets do not exist, technology is not equally distributed and technical diffusion takes time.

As last institutional form the state has to be included in analysis. Juillard and Boyer (1992) counter the prevalent narrative of 'crowding out' private investment and the inefficiency of public investment, suggesting instead that the latter can be productive. They argue that public investment positively influences productivity by enhancing production conditions e.g., infrastructure. Furthermore, the state holds many more instruments to affect markets. Thus, the forms of the state are deeply connected with the other two institutional forms mentioned above.

3.2.3 An Institutional Framework

There have been various attempts to include institutional notions to the post-Keynesian theory of productivity growth. Scholars approach this problem pragmatically by adding an institutional variable to the productivity equation as mentioned above (e.g., Storm & Naastepad, 2012, ch. 4). This includes institutions directly in the productivity picture. However, as straightforward and practical for estimations this may be[6], adding one variable does not do justice to the complexity of the influences the institutional forms can have on technical progress. In our post-Keynesian model of endogenous technical change, many variables are subject to the institutional environment. First and foremost, institutions affect distributional issues i.e., the profit share in this model. Furthermore, the state as the most present institution has capabilities to affect economic outcomes to a considerable extend. While state activity is left out by Hein and Tarassow (2010) and in other models, the authors already mention that the constant in the respective equation can be interpreted as effects independent of capacity utilization, capital accumulation or income distribution. Taking this idea further, the constant of the productivity regime can be reinterpreted as component independent of the demand and wage channel. In the same way, the constant of the demand regime is seen as autonomous demand that is mostly determined by institutions like in Sraffian supermultiplier models (Serrano, 1995). Thus, all variables of the regimes are open to institutional design. Focusing on one institutional variable is insufficient. Therefore, we have to examine the institutional effects on every variable.

Equation 7a and Equation 8a show the components that affect the partial regimes. Holding the productivity regime constant, the demand regime depends on autonomous demand, invest-

[6] However, there could also be multicollinearity problems of institutional and wage or demand indicators.

ment, consumption, and net exports. The profit share may affect various of these components. Depending on the respective strength of the effect, the demand regime can be either wage- or profit-led. In turn holding the demand regime constant, the productivity regime is affected by income distribution due to the Marx-Hicks effect. A constant grasps the autonomous innovation. Lastly, interaction between productivity and demand regime through the Verdoorn effect and the capital-embodied technical progress results in the overall effects. This threefold approach following Hein and Tarassow (2010) allows for the analysis of the effects of the institutional forms identified above on the identified variables and ultimately infer their consequence on the demand, productivity and overall regime. Assuming first a wage-led demand regime, Table 3.1 summarizes the effects of the institutional forms and their indicators on the regimes through the respective variables.

Mainly concerned with the design of industrial relations, the wage-labor nexus in Régulation Theory must align with the socio-technical regime to ensure the economic stability of technical progress. Sharing benefits from productivity gains with workers contributes to a social compromise. In line, Kleinknecht (2020) shows the beneficial effects of stricter labor market regulation on productivity growth. Arguing with the innovative environment, human capital development and firm structure, security for workers through employment protection will lead to higher productivity growth in Schumpeter Mark II economies. In Table 3.1, we display this effect with the positive sign for labor market regulation on autonomous innovation in the productivity regime. As regulation increases the power of workers in the labor market, it is likely to decrease the mark-up and therefore the profit share (Kalecki, 1954). Thus, we have again an indirect effect of labor market regulation on the productivity regime through the wage channel. The demand channel has a positive effect due to its wage-led character. Similar arguments can be made for an increase in bargaining power of workers, except that we do not see the direct influence on the innovative environment and the constant. For both indicators, the overall regime is expansive in capacity utilization, capital accumulation and productivity growth.

The degree of competition is another crucial factor in the creation of productivity growth. Frictions in technological diffusion hinder the equal distribution of technical progress and call into question the notion of gains through competition on perfect markets. Thus, market power and – more relevant in the context of financialization – intellectual monopoly are two fruitful indicators to grasp the effects related to the forms of competition. While intellectual monopoly in vein

Table 3.1: Theoretical effects of the institutional forms on the partial and overall regimes with a wage-led demand regime

Effect of	Wage-labor nexus		Forms of competition		Forms of the state	
	Labor market regulation	**Bargaining power**	**Intellectual monopoly**	**Market power**	**Public investment**	**Social welfare**
Effect on						
Demand regime						
Profit share	+	+	-	-	/	+
Autonomous demand	/	/	/	/	+	+
Investment	-	-	+	+	+	/
Consumption	+	+	-	-	+	+
Net exports	-	-	+	/	+	-
Wage-led demand regime	+	+	-	-	+	+
Productivity regime						
Profit share	+	+	-	-	/	+
Autonomous innovation	+	/	-	+	+	/
	+	+	-	+	+	+
Overall regime with wage-led demand regime						
Capacity utilization	+	+	-	?	+	+
Capital accumulation	+	+	-	?	+	+
Productivity growth	+	+	-	?	+	+

Notes: Own depiction; a plus represents a positive effect on the respective regime through the respective variable, a minus a negative effect, a slash indicates no effect, a question mark an undetermined one.

of Durand (2020) and Rikap (2021, 2023) leads rather to the protection of monopoly rents than investment in innovation, Schumpeter makes the argument for a positive connection of monopolistic tendencies and innovation. Only when entrepreneurs have the incentive of monopolistic rents in the future they will innovate (Schumpeter, 2020, ch. 8). Therefore, we conceptualize the contradicting indicators for the forms of competition as follows: Intellectual monopoly increases the profit share and hence has a negative effect on the productivity regime. Further, it decreases the autonomous innovation process as firm prioritize rent-seeking. The wage-led demand regime, that is affected negatively by the profit share rise, contributes through the Verdoorn relationship indirectly to a recessive productivity regime. Overall, the economy is affected negatively in all outcome variables. Contrary, market power increases the incentive to innovate and thus autonomous innovation by firms through investment. However, similar to intellectual monopoly the effects through the profit share and demand feedback are negative. To make the Schumpeterian argument, one has to assume that the effects on the autonomous innovation incentive exceeds the two negative effects. Then, the productivity regime is expansive. Nevertheless, the expansive productivity regime is still at odds with the contractive demand regime leaving us with an undetermined overall effect. To a degree these two indicators contradict each other and case analysis must reveal which effects are at play.

Lastly, we consider state policy and its variation. With its relevance for productivity growth highlighted above, public investment and social welfare are the two indicators used here. The former can take capacity or non-capacity building character. Most post-Keynesian models deal with non-capacity-creating state expenditure and, therefore, only study indirect effects on productivity through the demand channel (e.g., Nah & Lavoie, 2019). However, there are some approaches that consider both (e.g., Deleidi & Mazzucato, 2019). This is more in line with Régulation Theory as Juillard and Boyer (1992) argue for a direct positive effects of state investment on productivity. Not dealing with the exact modeling of state investment but the general notion of productive state activity such as in the case of industrial policy, we follow the latter understanding. Then, public investment raise the constant of the productivity regime and thus the whole regime directly. Furthermore, there are feedback effects through the demand regime as public investment triggers a rise in demand. Social welfare as another indicator for the type of state policy works indirectly. Following the orthodox argument of reservation wages (McCall, 1970), social welfare affects the labor supply i.e., higher welfare raises this wage threshold at which workers are willing to work (Cox & Oaxaca, 1992). Therefore, social welfare exerts wage

pressure affecting productivity growth through the smaller profit share. Furthermore, larger benefits increase demand. Thus, the Marx-Hicks effect is at play and with a wage-led regime also cumulative causation. Ultimately, the long-run overall regime is expansive in all outcomes for public investment and social welfare.

Assuming a profit-led demand regime blurs the picture. The expansive effect of a rising profit share in the profit-led demand regime is in contrast to the distinctively wage-led character of the productivity regime. The indirect demand effects are at odds with the direct effects and what dominates is not evident. The overall regime turns mostly undetermined as shown in Table 3.2. As elaborated in Hein (2014, ch. 8), the long-run regime can be expansive, intermediate or even contractive with a profit-led demand regime depending on the respective strength of the effects.

The only indicator whose overall effect becomes clearer with a profit-led demand regime is market power. Here, the overall regime turns from being undetermined to expansive. This is mainly due to the switch of the demand regime itself: The rising profit share through higher monopoly rents has positive demand effects now as investment increases more than consumption decreases. Leading to feedback effects through the demand channel, this adds even more to the already expansive productivity regime in the Schumpeterian sense. One exception of the changing picture is public investment which retains its positive influence on all demand components and thus productivity growth through the Verdoorn relationship. Even under a profit-led demand regime, stimulating the economy with public expenditure has a positive effect as it mainly acts through autonomous innovation and not through the profit share.

4 Varieties of Productivity Regimes in Germany and the US

Incrementally, we will now go over the macroeconomic and institutional indicators identified in the theoretical synthesis in section 3, search for fitting data and analyze them descriptively to receive a picture of the institutional form in Germany and the US. Furthermore, we will carry out a regression analysis. In combination, this will allow to derive different productivity regimes – as part of the overall regime – for the two economies from their respective outcomes and the analysis of their institutional settings.

The Appendix collects all the sources, descriptions and calculation of the variables. In case the variables and indicators do not come as rate, index or pure number, they are normalized by GDP, not by the nominal capital stock like in section 3 assuming the capital-output ratio to be constant

Table 3.2: Theoretical effects of the institutional forms on the partial and overall regimes with a profit-led demand regime

Effect of	Wage-labor nexus		Forms of competition		Forms of the state	
	Labor market regulation	**Bargaining power**	**Intellectual monopoly**	**Market power**	**Public investment**	**Social welfare**
Effect on						
Demand regime						
Profit share	-	-	+	+	/	-
Autonomous demand	/	/	/	/	+	+
Investment	-	-	+	+	+	/
Consumption	+	+	-	-	+	+
Net exports	-	-	+	/	+	-
Profit-led demand regime	-	-	+	+	+	-
Productivity regime						
Profit share	+	+	-	-	/	+
Autonomous innovation	+	/	-	+	+	/
	+	+	-	+	+	+
Overall regime with profit-led demand regime						
Capacity utilization	?	?	?	+	+	?
Capital accumulation	?	?	?	+	+	?
Productivity growth	?	?	?	+	+	?

Notes: Own depiction; a plus represents a positive effect on the respective regime through the respective variable, a minus a negative effect, a slash indicates no effect, a question mark an undetermined one.

in Kaldorian vein.

4.1 Macroeconomic Indicators

The post-Keynesian model presented above stresses the endogenous variables capacity utilization, capital accumulation and obviously productivity growth. These are mainly affected through changes in output growth and distribution i.e., the profit share. As further important indicators, we add the trade balance to the picture. In the following, we refer to these variables as macroeconomic indicators that refine the economic outcome of the two growth regimes of Germany and the US beyond the pure analysis of productivity growth in section 2. Table 4.1 presents figures for these indicators.

Looking at the medium- to long-run trend of functional income distribution, reveals an increase in the profit share in Germany and the US – more pronounced in the latter. Table 4.1 shows that the average profit share increases by 0.75 percentage points in Germany compared to 3.52 percentage points in the US between the pre- and post-GFC period. Besides harsher pro-cyclical fluctuation of the profit share, we identify a long-run redistribution towards profits.

Measuring capacity utilization is highly controversial. Post-Keynesian accounts criticize the usual calculation of the rate as the actual production over potential production derived from a production function as cyclical (Nikiforos, 2021). The associated policy recommendations encourage pro-cyclical action (Heimberger & Kapeller, 2017). As a solution, Nikiforos (2021) recommends to use survey data on utilization to analyze companies' capacity as they depict the more realistic utilization in the long run as observed by producers themselves[7]. In Table 4.1 we go even further and present the change rate of the utilization rate indicating the growth *dynamics* of the respective economy. This allows for an examination beyond the different levels of capacity utilization in Germany – on average 83.63% in the whole observed period – and the US – on average 77.08% (OECD, 2024a).

Table 4.1 shows that conventional calculations indicate an increase in the rate of change for capacity utilization in Germany between the pre- and post-GFC period, although it remains negative, while the US see a decrease in this rate. However, using non-conventional methods suggests stronger growth dynamics in capacity utilization in the US. The economy exhibits a

[7] In the following, we refer to the utilization rate calculated with an output gap approach as 'conventional' and to the rate based on survey data as 'non-conventional'.

Table 4.1: Averages and changes of macroeconomic indicators; Germany and the US; overall, before and after the GFC

	Germany				US			
	Overall	Pre-GFC	Post-GFC	Change	Overall	Pre-GFC	Post-GFC	Change
Output growth (%)	1.28	1.39	1.08	−0.31	2.43	3.13	1.83	−1.30
Productivity growth (%)	1.22	1.71	0.77	−0.94	1.61	2.03	1.21	−0.82
Profit share (%)	42.20	41.64	42.39	0.75	41.62	39.98	43.50	3.52
Change in capacity utilization (%)								
– Conventional calculation	−0.10	−0.23	−0.06	0.17	0.08	0.23	0.05	−0.18
– Non-conventional calculation	0.06	0.01	0.10	0.09	0.10	0.05	0.55	0.50
Capital accumulation rate (%)	1.23	1.71	0.74	−0.98	2.39	2.86	1.83	−1.03
Net exports share (% of GDP)	3.83	1.80	5.78	3.98	−3.04	−2.73	−3.11	−0.38

Notes: Own calculations based on OECD (2024c, 2024d), European Commission (2023), and OECD (2024a), . Overall: 1991–2022; pre-GFC: 1991–2006; post-GFC: 2009–2022; change: difference between the pre- and post-GFC period. Rates of change calculated from 1992 onwards. Conventional data for capacity utilization refers to output gap estimations, while non-conventional data to survey data in manufacturing.

more than five times higher increase in the annual change of the utilization rate between the two periods than Germany. Quite the opposite is true for capital accumulation measured by the growth of net capital stock. Both economies decrease their capital accumulation rate post-GFC, the US slightly more than Germany. However, the US decline on a higher level of capital accumulation having on average almost twice the rate over the whole period. Generally, the US show a more robust economic situation regarding these demand-determined factors of output growth in the post-GFC period than Germany. This picture is reversed for exports. Large export surpluses are a recurring theme when talking about Germany. Table 4.1 confirms this once more. Before and after the GFC Germany has a notable exports surplus that increases by nearly 4 percentage points between the periods. Meanwhile, the US exhibit a growing export deficit.

This is in line with a vast amount of post-Keynesian research that classifies Germany as export-led mercantalist (ELM) and the US as debt-led private demand (DLPD) regime that turned into a domestic demand-led with high public sector deficits (DDL) one after the GFC (Akcay et al., 2022). Herein, Germany experiences lower output growth on a lower level due to weakened demand dynamics, especially regarding capacity utilization and accumulation. At the same time, the economy is mitigating this problematic development for growth with the help of foreign demand. The exports surplus rate is growing. Meanwhile, the US with its trade deficits exhibit higher output growth connected to higher growth rates in capacity utilization and accumulation rates. In this period, the profit share increases in both economies.

4.2 Institutional Indicators

The next step in determining an economy's productivity regime is to analyze the indicators of the three institutional forms – the wage-labor nexus, the forms of competition, and the state. These serve as the model's exogenous variables, yielding the macroeconomic indicators. Table 4.2 presents data for the variables that numerically represent the indicators associated with the institutional forms.

4.2.1 Wage-Labor Nexus

A long-established indicator of labor market regulation is the OECD's Employment Protection Legislation (EPL) index (OECD, 2021). It reflects the legal framework of a country's employment protection and provides different versions with varying weightings for divers periods

Table 4.2: Averages and changes of institutional indicators; Germany and the US; overall, before and after the GFC

	Germany				US			
	Overall	Pre-GFC	Post-GFC	Change	Overall	Pre-GFC	Post-GFC	Change
EPL_t (Index)	1.75	2.27	1.12	−1.14	0.25	0.25	0.25	0.00
Bargaining coverage (% of workers)	64.19	70.14	57.59	−12.55	14.15	15.57	12.38	−3.19
Change in patent applications (%)	1.11	4.87	0.25	−4.62	1.86	4.36	3.25	−1.11
Market concentration (%)	16.73	18.01	15.22	−2.78	39.62	36.00	42.33	6.33
Public investment (% of GDP)	2.38	2.47	2.34	−0.13	3.66	3.81	3.45	−0.37
Social welfare (% of GDP)	12.02	11.36	12.90	1.54	6.16	6.08	6.22	0.14

Notes: Own calculations based on OECD (2021), OECD and AIAS (2023), OECD (2023), Monopolkommission (2022a), Fortune (2024), and European Commission (2023). Overall: 1991–2022; pre-GFC: 1991–2006; post-GFC: 2009–2022; change: difference between the pre- and post-GFC period. Rates of change calculated from 1992 onwards. For changes in patents, 2020 is excluded due to high distortion caused by Covid.

starting from the 1980s. There exist one index for the regulation of the dismissal of regular contracts (EPL_r) and one for the use of temporary workers (EPL_t)[8]. Together these two indices shed light on the economy's strictness of labor market regulation. A higher number indicates stricter regulation.

As legal regulation naturally does not change rapidly, it does not surprise that the indices for the US do not alter at all as seen in Figure 4.1. The EPL_r and the EPL_t are both at a consistently very low level. Similarly, the index for regular contracts in Germany does not alter much. This is quite surprising as the German labor market has undergone drastic changes and a major reform at the beginning of the 2000s. However, Herzog-Stein et al. (2010) point out that the Hartz reforms especially targeted external flexibility in the labor market, i.e. deregulation of temporary contracts. In line with that, the EPL_t declined drastically from 1995 until 2004 reflecting the deregulation. This manifests in a decline of the average index between the pre- and post-GFC period depicted in Table 4.2. Nevertheless, this comparison points out that Germany still has a much more strictly regulated labor market than the US.

The simultaneous decline of the wage share and bargaining power is a common result of empirical exercises on the topic (e.g., Guschanski & Onaran, 2022). Mostly, scholars use union density as measure of bargaining power. The rationale for this is that unions can bargain better with more members by building up more pressure on employers. However, looking solely at union

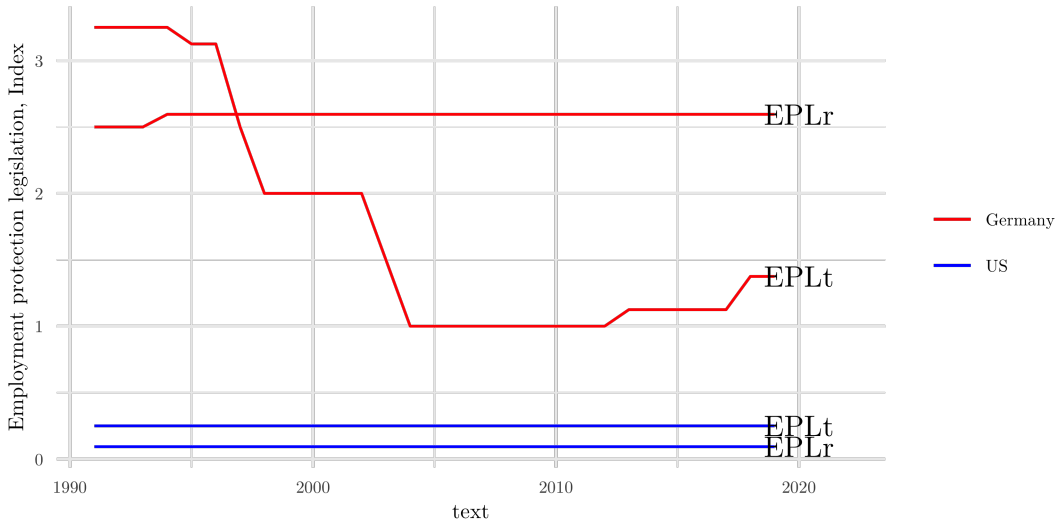


Figure 4.1: Employment Protection Legislation, Germany and the US, 1991–2019
Source: Own depiction; data from OECD (2021).

[8] For a detailed look into the methodology of these indices, see OECD (2020, ch. 3).

density might be insufficient. Fitzenberger et al. (2006) argue that union density measures pre-bargaining power while the coverage rate of union-bargained wages indicates post-bargaining power. Heterodox authors agree with this differentiation (e.g., Guschanski & Onaran, 2022) that is especially important in the context of Germany with strong institutional power of unions beyond the mere bargain itself. Thus, analyzing the bargaining coverage rate – i.e. the rate of workers that earn an union wage – includes more facets of workers' power.

Table 4.3 compiles data on both measures. Germany and the US show a clear downward trend of union density and coverage. This trend is most pronounced in German union density. From 1991 until 2019, the rate has more than halved from 36% to 16.3%. But also the coverage rate decreased from 80.8% in 1995 to 54% in 2018. Both rates are, nonetheless, considerably higher in Germany than the US. Another remarkable observation is the divergence of the two rates in Germany indicating an institutional framework that stabilizes labor to some extend. Meanwhile, union density and the coverage rate is nearly indistinguishable in the US at a level between 10% and 20% and slightly decreasing. This trend shows beyond the short run as depicted in Table 4.2. There is a decline of the average bargaining coverage in Germany and the US. While it is on notable higher level in Germany, it at the same time decreases with higher absolute numbers.

Not surprisingly, Germany still has a more regulated labor market. However, this system seems to deteriorate. The figures above stipulate that Germany liberalizes and moves towards the US. It seems like there is a shift of CMEs such as Germany towards LMEs in this period due to the liberalization of labor markets. However, scholars disagree on whether this is solely a trend towards the US or whether a new system is emerging in CMEs that is characterized by 'institutional dualism' meaning it is at the same time less harsh than the US but also less oriented toward equality than before (Palier & Thelen, 2010; Hassel, 2014). While this CPE discussion goes beyond the scope of this paper, the main insight here is that the German wage-labor nexus undergoes substantial change since 1991 while the US system remains stable in its liberal approach.

4.2.2 Forms of Competition

The forms of competition are the only institutional form in this work where effects may counteract each other. While intellectual monopoly leads companies to prioritize rent-seeking over innovation, the Schumpeter argument is that future market power is necessary to push for inno-

Table 4.3: Indicators for bargaining power, Germany and the US, 1991–2020

	Union density (%)		Coverage rate (%)	
Year	Germany	US	Germany	US
1991	36.0	17.3		18.1
1992	33.9			17.7
1993	31.8	16.9		17.6
1994	30.4			17.5
1995	29.2	16.2	80.8	16.7
1996	27.8		75.7	16.2
1997	27.0	15.6	74.9	15.6
1998	25.9		73.6	15.4
1999	25.3	15.0	70.6	15.3
2000	24.6		67.8	14.9
2001	23.7	14.6	68.8	14.7
2002	23.5		67.8	14.5
2003	23.0	14.1	67.6	14.3
2004	22.2		65.8	13.8
2005	21.5	13.6	64.9	13.7
2006	20.6		63.4	13.1
2007	19.8		61.7	13.3
2008	19.0	12.9	61.3	13.7
2009	18.8		61.7	13.6
2010	18.9	13.2	59.8	13.1
2011	18.4		58.9	13.0
2012	18.3		58.3	12.5
2013	18.0		57.6	12.4
2014	17.7	12.1	57.8	12.3
2015	17.6		56.8	12.3
2016	17.0	11.5	56.0	12.0
2017	16.7		55.0	11.9
2018	16.6		54.0	11.7
2019	16.3			11.6
2020				12.1

Note: 'Coverage rate' refers to the adjusted bargaining coverage rate derived from surveys.
Source: OECD and AIAS (2023).

vation. In the following, we set out to review these two forces.

Intellectual monopoly – despite being a comprehensive theory – can be grasped quite easily for the purpose of the present paper. As Rikap (2021, ch. 3) points out, intellectual property rights (IPRs) are the main tool of companies to privatize public knowledge. Alongside many other legal constructs, patents are probably the central element of IPRs and strongly connected to firm's innovation processes. They are used here as an indicator of monopolistic tendencies.

Connected with the realm of financialization (Auvray et al., 2021) rising numbers of patents would herein not signal an 'inventive spirit' but rather a privatization of existing knowledge, the division of innovation into smaller elements to make copying more difficult, and an increase in the relevance of intangible assets. Especially its concentration would be a good indicator of monopoly tendencies (Rikap, 2021, ch. 2). Although, this analysis goes beyond the scope of this paper.

Therefore, we use the change rate of patents filed to the IP5 family by inventors with German or US residence. As we can see in Table 4.2, the patent dynamics start on a slightly higher level in Germany than the US in the pre-GFC period. However, the difference in the post-GFC period is striking. While there is a decrease in the US from 4.36% annual change on average in the first to 3.25% in the second period, patent applications are nearly not growing at all anymore in Germany after the GFC – only 0.25% annually on average. These figures allow the conclusion that intellectual monopoly is more pronounced in the US than the German case post-GFC.

With regard to the theoretical effect of market power, finding suitable data is more difficult. Measuring market power is subject to various objections. As markets are hard to define, competition can be high even in concentrated markets and the concept of power is quite vague, scholars focus on measuring the outcome of market power to determine it indirectly i.e., they measure mark-ups (Weche & Wambach, 2021). However, since this paper is based on Kaleckian theory, the mark-up is not solely dependent on the degree of market perfection, but its imperfection is fundamental and dependent on other factors like workers' power (Hein, 2023a, ch. 3). In order to achieve a clear differentiation from other institutional forms – especially the wage-labor nexus –, the expectations of a higher market share should be utilized to examine the Schumpeterian argument of a needed incentive to invest in innovation. Popular measures for market concentration are the Herfindahl–Hirschman index or concentration rates (e.g., Grullon et al., 2019). To circumvent problems like diverging sector and firm categorization, we scrutinize data on the top 100 companies in Germany and the US. Hereby, we avoid the problem of market delineation and can focus on the market power of the largest market actors regardless of sectors. This also circumvents the problem that big firms can be active in various sectors pointed out by Bajgar et al. (2023). Usually, summed share in total value added of all top 100 companies is used as an indicator of corporate concentration and the resulting political and economic power (Buchwald et al., 2021).

Looking at the market share of the top 100 firms in Germany, a clear trend is visible. Table 4.2 shows that the average market share of the top 100 German companies declined between the pre- and the post-GFC period. This points towards a development in Germany that moves its economy away from big players towards a more competition-based model. This is often referred to as the descent of the 'Deutschland AG' – the notion of such a network characterizing German corporate governance (see e.g., Streeck & Höpner, 2003).

Meanwhile, existing literature suggests an opposite trend in the US. Focusing on public US firms between 1972 and 2014, Grullon et al. (2019) find that 75% of respective industries increased their concentration. Accordingly, market power developed into a more important source of value for US companies. This is in line with the findings of Davis and Orhangazi (2021) who add that there are specific sectors driving these results and not all concentrated sectors show signs of higher market power. However, the literature does not present a measure of market concentration that is similar to the favorable German top 100 market share and therefore make the two economies comparable. We advance there by building an alike indicator that bases on the well-known Fortune 500 list (Fortune, 2024). Taking the first 100 companies listed there, market concentration is measured as share of their summed revenue in nominal GDP. While this approach addresses the aforementioned data issues, it also introduces challenges, primarily due to differences in the calculation methods between the German top 100 variable and the one developed for the US. While the Monopolkommission (2022a) uses data on domestic value added of the largest 100 German companies regardless of their stock market listing, Fortune (2024) only identifies revenue data of publicly listed US companies that we supplement with nominal GDP data. Therefore, the level of the two variables is not comparable as they measure different things. Nevertheless, we are able to analyze their development i.e., changes in market concentration. More fundamentally, Fortune (2024) only lists publicly listed companies. However, it is unlikely that private companies would appear in this list given the strong focus on stock markets in the US. Furthermore, only 13 of the 100 companies ranked in 2014 – the last year the authors even state this characteristic – were pure private companies in Germany. Thus, a big majority of the big players in Germany are listed, too. Thus, the only crucial aspect where the measures deviate is that the US data contains global revenues of companies while the German TOP 100 bases on *domestic* value added. The data for the US is therefore distorted by international cash flows.

With these problems in mind, the data nevertheless shows an increase in market concentration in the US. As depicted in Table 4.2, the market share of the top 100 US companies increased by 6.33% between the two analyzed periods. We have a more concentrated market post-GFC in the US.

Ultimately, we see signs for stronger intellectual monopoly tendencies and higher market concentration in the US. Meanwhile, the opposite is true for Germany. Increases in patents application nearly come to a hold post-GFC and market concentration is decreasing. At the same time, productivity growth is declining in both economies. If we would consider this ceterius paribus, this means that the arguments of the intellectual monopoly literature apply more in the US as the negative effects of rent seeking seem to outweigh the possible positive ones of future profits on innovation. In Germany, it dominates the declining market concentration that affects incentives to innovate negatively with a negative outcome regarding productivity growth. Declining intellectual monopoly cannot counter this. However, the assumption of no other change is very critical in this context as all other figures presented here show that parameters actually change. Thus, we cannot identify the distinct effect of competition in Germany and the US.

4.2.3 Forms of the State

The state's economic behavior is quite easy to observe due to the public availability of national accounts. In the theoretical framework, we try to grasp two aspects of the forms of the state, public investment and social welfare.

First, its own innovative action i.e., industrial policy, investment and funding of R&D, affects technical change. There are various possibilities to approach this realm. Usually, public investment is measured by looking at governmental gross fixed capital formation (GFCF). Alternatively, we could scrutinize data explicitly on R&D expenditure. However, it is not sufficient in the context at hand. Of course, R&D data unfolds direct insights into state intervention in technical change. Nonetheless, this widespread measure narrows downs the view on state investment solely on explicit research projects. This is not in line with the broader view of state activity and its effect on productivity presented in section 3. Since the revision of the systems of national accounts governmental GFCF slowly also recognizes the relevance of R&D in capital formation. Meanwhile, the result of R&D activity i.e., intellectual property products, are included in GFCF and, therefore, accepted as one part of public investment with a direct effect

on productivity (United Nations, 2009, p. 206). However, just public investment measured by GFCF grasps the indirect effects of state activity as well. Although it encompasses all assets acquired, it should be a good proxy for the innovative investment of the state including its direct and indirect effects.

Empirically, the analysis of R&D data does provide more insights regarding the comparison of Germany and the US relative to using figures on public investment. Table 4.4 compares data on public investment already used in Table 4.2 with R&D measures. Herein, gross domestic expenditure on R&D (GERD) financed by the government quantifies state R&D expenditure. The tables shows that the level of R&D expenditure is similar in Germany and the US. In the former, expenditure shares are slightly increasing pre- to post-GFC, while in the latter the average numbers are decreasing moderately.

Table 4.4: Comparison of average data on public investment and R&D expenditure by government; Germany and the US; overall, before and after the GFC

	Overall	Pre-GFC	Post-GFC	Change
Germany				
Public investment (% of GDP)	2.38	2.47	2.34	−0.13
GERD financed by government (% of GDP)	0.80	0.78	0.85	0.08
US				
Public investment (% of GDP)	3.66	3.81	3.45	−0.37
GERD financed by government (% of GDP)	0.77	0.81	0.73	−0.07

Notes: Own calculations based on European Commission (2023) and OECD (2024b). GERD: Gross domestic expenditure on R&D. Overall: 1991–2022; pre-GFC: 1991–2006; post-GFC: 2009–2022; change: difference between the pre- and post-GFC period. Data on 2022 missing for German GERD financed by government.

Despite the imperfect inclusion of R&D expenditure by the government GFCF, the measure suits the arguments followed here better. Table 4.2 contains the medium- to long-run numbers on public investment. We see a small decrease in public investment shares of GDP in Germany and the US between the two period before and after the GFC. However, the US invest substantially more publicly than Germany pre- and post-GFC – on average about 1.5 times as much.

Second, social expenditure as redistributive policy related with the wage-labor nexus acts mainly through the Marx-Hicks effect on productivity growth while also stem from the form of the state. Table 4.2 reveals the opposite picture for social expenditure than for public investment. Both figures for Germany and the US increase from the pre- to the post-GFC period while Germany has a share of social expenditure twice as high.

While its orientation towards redistributive state policy seems to persists, Germany lacks behind in terms of public investment. This fits to its common perception as thrifty, especially in the context of the EU. On the opposite, the US implements a policy of higher public investment and lower social expenditure.

4.3 Regression Analysis

Going beyond the pure descriptive analysis, the following should be a first step towards an examination using inferential statistics. We estimate the connection between the institutional forms and productivity growth with an OLS regression independently for Germany and the US in the period from 1991 to 2022. We do not distinguish between the pre- and post-GFC period here anymore as the numbers of observations would be too small. In these kinds of regressions, we face the usual problem dealing with institutions in economic context. Efendic et al. (2011) rightly point to the treatment of potential endogeneity of institutions as the main challenge of empirical work in the field. The empirical strategy here wants to identify the overall effect through the different channels proposed earlier.

Contrary to usual estimations of the productivity regime, we do not solely consider the Verdoorn and Marx-Hicks effect (like, for example, Setterfield & Cornwall, 2002; Naastepad, 2006; Hein & Tarassow, 2010; Hartwig, 2014) and also not just add an institutional variable (like, for example, Storm & Naastepad, 2012, ch 4). Rather, we will examine how the institutional forms *directly* and *indirectly* affect productivity growth – the latter through altering the distribution and demand. Table 4.5 shows the correlation between the indicators and the elements of the productivity regime in Germany and the US to give a first impression of possible mechanisms. It, furthermore, can help to verify the theoretical conceptualization in Table 3.1 as it is its empirical counterpart. Regarding the labor market regulation we use the EPL_t as this index shows more variation than the EPL_r – at least for Germany.

The outcomes for Germany mostly align with the theoretical model. The EPL_t index, the bargaining coverage rate and public investment are positively correlated with productivity growth i.e., could have a direct positive effect on it. However, only the effect of the EPL_t is significant. Interestingly, the wage channel exhibits robustness over these three indicators. All their correlations are significant and have the opposite sign of productivity growth pointing towards the negative influence of an increasing profit share on productivity growth as indirect effect. This

Table 4.5: Correlation between indicators and elements of the productivity regime, Germany and the US, 1991-2022

	EPL_t	AdjCov	ΔPatents	Con	PubI	SocEx
Germany						
ŷ	0.44*	0.25	0.27	0.64*	0.26	−0.37*
h	−0.80*	−0.49*	−0.43*	−0.24	−0.74*	0.03
u	0.23	−0.14	−0.29	0.32	0.20	−0.36*
US						
ŷ	NA	0.14	0.00	−0.37	0.42*	0.22
h	NA	−0.83*	−0.09	0.66*	−0.60*	0.24
u	NA	−0.12	−0.04	−0.46*	−0.42*	−0.57*

Notes: Own calculation based on OECD (2024d), OECD and AIAS (2023), OECD (2023), Monopolkommission (2022a), Fortune (2024), European Commission (2023). 'EPL_t' refers to the OECD's EPL index for temporary workers, 'AdjCov' to the bargaining coverage rate, 'ΔPatents' to the change in the number of patents, 'Con' to market concentration, 'PubI' to public investment share of GDP, and 'SocEx' to social expenditure share of GDP. Correlation of variables are calculated with Pearson's r and p-Values using a t or F distribution; p-Value: "*" < 0.05.

was a theoretical argument before for labor market regulation and bargaining power, however not for public investment. For labor market regulation and public investment, the Verdoorn relationship holds regarding the sign of the respective correlation. However, none is significant to the usual level. Regarding the different arguments about competition, the correlations suggest that market concentration fosters productivity growth in Germany. We see a significant correlation between the respective variables. Surprisingly, a higher increase in patent application is associated with a lower profit share what contradicts the arguments of the intellectual monopoly literature about rent seeking.

Social expenditure is the big exception of the overall picture. Despite the theoretical argument above that it should foster technical progress through its redistributive measures, it is negatively correlated with productivity growth. One explanation for this is again its function as automatic stabilizer. Computing the correlation in one specific year, social expenditure will rise in a recession that also lowers productivity growth. This is in line with the significant negative correlation on a similar level of social expenditure with capacity utilization.

Due to the non-existent variation in EPL_t in the US, this indicator cannot be interpreted in bivariate data analysis. Besides that, the picture for the US mostly fits to our theory, too. The signs of the correlation of the indicators with the profit share and productivity growth are opposing each other; the coverage rate and public investment significantly correlate negatively with the profit

share. Both also exhibit a direct positive correlation with productivity growth. Although, it is only significant for public investment. Contrary to Germany, market concentration is negatively correlated with productivity growth, but also insignificant to the 5% level. However, it seems that higher concentration is connected with a higher profit share in the US and a lower rate of capacity utilization. In line with our theoretical arguments, this is associated with a negative direct effect on productivity growth, what, however, appears insignificant here.

Meanwhile, changes in patents do not at all have a correlation with any element of the productivity regime in the US. All values are near zero and insignificant. The negative effect of public investment and social welfare on capacity utilization is at odds with the theoretical arguments. Again, cyclical dependency could be a reason for that.

To control for further omitted variables and to identify the specific effects in conjunction, we carry out a regression analysis. The strategy is to first only include the indicators for the institutional form to summarize their direct and indirect effect on productivity growth in the respective coefficient. Incrementally, we add controls and later the profit share and capacity utilization to distinguish between the direct and indirect effects. Herein, productivity growth is constructed as five-year moving average to decrease the cyclical dependency and to grasp the effect on future figures. The correlation matrices (see Appendix) show that we have no case of perfect collinearity between the variables in both economies. Thus, we can estimate the following three models:

$$\hat{y}_{\text{ma(5)}} = \beta_0 + \beta_1 \text{EPL}_t + \beta_2 \text{AdjCov} + \beta_3 \Delta\text{Patents} + \beta_4 \text{Con} + \beta_5 \text{PubI} + \beta_6 \text{SocEx} \tag{12a}$$

$$\hat{y}_{\text{ma(5)}} = \beta_0 + \beta_1 \text{EPL}_t + \beta_2 \text{AdjCov} + \beta_3 \Delta\text{Patents} + \beta_4 \text{Con} + \beta_5 \text{PubI} + \beta_6 \text{SocEx} + \beta_7 \text{Mshare} + \beta_8 \text{Gap} \tag{12b}$$

$$\hat{y}_{\text{ma(5)}} = \beta_0 + \beta_1 \text{EPL}_t + \beta_2 \text{AdjCov} + \beta_3 \Delta\text{Patents} + \beta_4 \text{Con} + \beta_5 \text{PubI} + \beta_6 \text{SocEx} + \beta_7 \text{Mshare} + \beta_8 \text{Gap} + \beta_{12} h + \beta_{13} u \tag{12c}$$

Table 4.6 presents the estimation results for Germany. Most interestingly, EPL_t index has a significant effect on the productivity growth moving average in model 1 and 2. The effect becomes

Table 4.6: Regression results, Germany

	Dependent variable:		
	Productivity growth, moving average		
	(1)	(2)	(3)
Constant	5.18	1.17	−2.84
	(3.35)	(4.56)	(12.57)
EPL_t	1.01***	0.49*	0.44
	(0.17)	(0.26)	(0.28)
Coverage rate	−0.02	−0.03	−0.01
	(0.02)	(0.05)	(0.06)
Change in patents	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)
Market concentration	0.07	0.05	0.02
	(0.06)	(0.05)	(0.07)
Public investment	−2.25***	−1.71***	−1.64***
	(0.44)	(0.44)	(0.48)
Social expenditure	−0.04	−0.06	0.09
	(0.19)	(0.17)	(0.35)
Manufacturing share		0.29	0.27
		(0.33)	(0.45)
Gap to US		0.04	0.01
		(0.02)	(0.03)
Profit share			−0.03
			(0.10)
Capacity utilization			0.03
			(0.03)
Observations	23	23	23
R^2	0.91	0.94	0.94
Adjusted R^2	0.87	0.90	0.89
Residual Std. Error	0.19 (df = 16)	0.17 (df = 14)	0.17 (df = 12)
F Statistic	26.11*** (df = 6; 16)	26.19*** (df = 8; 14)	19.19*** (df = 10; 12)

Notes: *p<0.1; **p<0.05; ***p<0.01. Datasets: OECD (2024d), OECD and AIAS (2023), European Commission (2023), Monopolkommission (2022a), OECD (2023). Future five-year moving average of productivity growth. Function: lm

insignificant when adding the profit share and the rate of capacity utilization. This suggests an effect, firstly directly on productivity, but above all via the wage channel. Surprisingly, public investment has a significant negative coefficient that we cannot explain with our theory. With regression model 3, we are not able to find a Verdoorn or Marx-Hicks connection.

Table 4.7 shows the results for the US. Again, the EPL_t coefficient cannot be computed. Despite being jointly significant, the coefficients of the model indicate weak insights as they are mostly insignificant. Only the indicators for the institutional form of the state are in line with our theory. In model 2, they suggest a positive effect of public investment and social expenditure on productivity growth in the next five years. Contrary to the theoretical arguments, the coverage rate seems to be negatively affecting productivity. However, its coefficient is insignificant in model 1 and 3. Model 3 indicates a significant Marx-Hicks effect in the US but no Verdoorn relationship.

Before summarizing these regression results, we should address some of their caveats. First, this regression focuses short-term effects of five years. Theoretically, we argue in the realm of long run effects of post-Keynesian growth models. A five year period is in no way long-term, maybe not even medium-term. It still is heavily dependent on an economic cycle. Thus, more work needs to be done on this aspects of the presented work like including lags or further moving averages in a bigger observation period. Furthermore, calculations of the increases in the forms of the state for the case of the US seem ridiculously high. This prediction could be wrong due to the low prediction power in the area of such big increases. The average change in US public investment in the observed period is -0.04 percentage points. This is way lower than a whole percentage point. Lastly, we deal with various level variables in this regression. Including changes for utilization rates and the profit share could refine the picture with more dynamic effects. However, this seems to not alter the results like shown in the Appendix.

Nevertheless, we can infer some insights from the regressions above. The results of the regression for Germany point towards a significant effect of indicators for the wage-labor nexus on productivity growth. Meanwhile, public investment and social expenditure is the most striking factor in the US showing positive impact on productivity growth.

4.4 Classification of the Productivity Regimes

Scholars clearly categorize Germany's demand regime as wage-led in domestic and total demand (for an overview of the findings, see Hein, 2014, p. 302). The US demand regime is more controversial. While some find profit-led regimes, Blecker (2016) argues that these findings are due to the focus on short-term effects. Contrarily, the author assesses that in the long run the US' demand regime is more likely to be wage-led. As we deal with the long run in exam-

Table 4.7: Regression results, US

	Dependent variable:		
	Productivity growth, moving average		
	(1)	(2)	(3)
Constant	−4.16	−11.04**	−0.39
	(4.96)	(5.17)	(19.23)
EPL_t			
Coverage rate	0.02	−1.30**	−0.50
	(0.16)	(0.55)	(0.64)
Change in patents	−0.01	−0.005	0.01
	(0.02)	(0.01)	(0.01)
Market concentration	−0.05	−0.05	−0.03
	(0.05)	(0.04)	(0.04)
Public investment	1.48	1.61*	1.03
	(0.87)	(0.77)	(0.91)
Social expenditure	0.35	2.60*	2.25
	(1.16)	(1.37)	(2.47)
Manufacturing share		1.07**	0.12
		(0.43)	(0.61)
Profit share			−0.34**
			(0.16)
Capacity utilization			0.07
			(0.08)
Observations	24	24	24
R^2	0.57	0.68	0.76
Adjusted R^2	0.45	0.57	0.64
Residual Std. Error	0.51 (df = 18)	0.45 (df = 17)	0.42 (df = 15)
F Statistic	4.74*** (df = 5; 18)	6.11*** (df = 6; 17)	6.06*** (df = 8; 15)

Notes: *p<0.1; **p<0.05; ***p<0.01. Datasets: OECD (2024d), OECD and AIAS (2023), European Commission (2023), Fortune (2024), OECD (2023). Future five-year moving average of productivity growth. Function: lm

ining productivity growth, we stick to the later explanation. Therefore, we should expect the theoretical effects depicted in Table 3.1 for both Germany and the US.

In the German case, the descriptive and the regression analysis suggests that the wage-labor nexus is crucial to understand the economy's decline in productivity growth i.e., for its productivity regime. We find significant positive effects of labor market regulation. Meanwhile, descriptive data presented above indicates that Germany undergoes serious changes in this in-

stitutional form, especially during the 2000s, resulting in a deterioration of respective figures between the period before and after the GFC. The connected labor market reforms known under the headline of the 'Agenda 2010' can be seen as a regime change from a Régulation point of view. Germany is looking for a new mode of regulation that fits to the accumulation regime regarding the wage-labor nexus. Results are profound changes in regulation, workers' bargaining power and the overall growth regime connected with wage moderation and export orientation. This deteriorates German productivity growth substantially through the Marx-Hicks effect and leads to a severe decline in its growth rates. This is in line with the arguments of Storm and Naastepad (2015): In the past, Germany built a model of cooperative capitalism focused on quality rather than price competitiveness. Some of these achievements remain and make a successful reaction to crises possible but there is a clear shift away from these policies towards the one perceived as 'neoliberal'. Thus, declining wage shares and the labor market reforms strike at the core of the German economic model.

Meanwhile, the US productivity regime seems not to react too harsh on changes in the wage-labor nexus. The labor market is anyways deregulated and the regression shows that respective variables have no significant effects. Rather, our estimation suggests that public investment plays a crucial role in the US. This state activity – somewhat in line with the argument of the entrepreneurial state by Mazzucato (2011) – targets mostly political objectives in the US context e.g., international competition from East Asia. This special kind of industrial policy favors US networks of firms and their innovative capabilities (Wade, 2014). Nevertheless, various studies find a negative effect of declining wages shares on productivity growth also in the US (e.g., Hein & Tarassow, 2010). It is likely that falling wages shares had indeed a similar effect as in Germany pointing towards the Régulation argument of similar historical periods. However, the different manifestation of the institutional forms in the two economies can explain the cushioned trend in the US. The economy with the high rates of public investment pre- and post-GFC can maintain somewhat higher productivity growth rates. The wage-labor nexus is not that central as in Germany.

The forms of competition elude from a final discussion here. The empirical strategy fails to makes sense of its contrary effects between innovation incentive and rent-seeking behavior. However, as suggested by various research the intellectual monopoly tendencies are more pronounced in the US where market concentration seem to increase while it decreases in Germany.

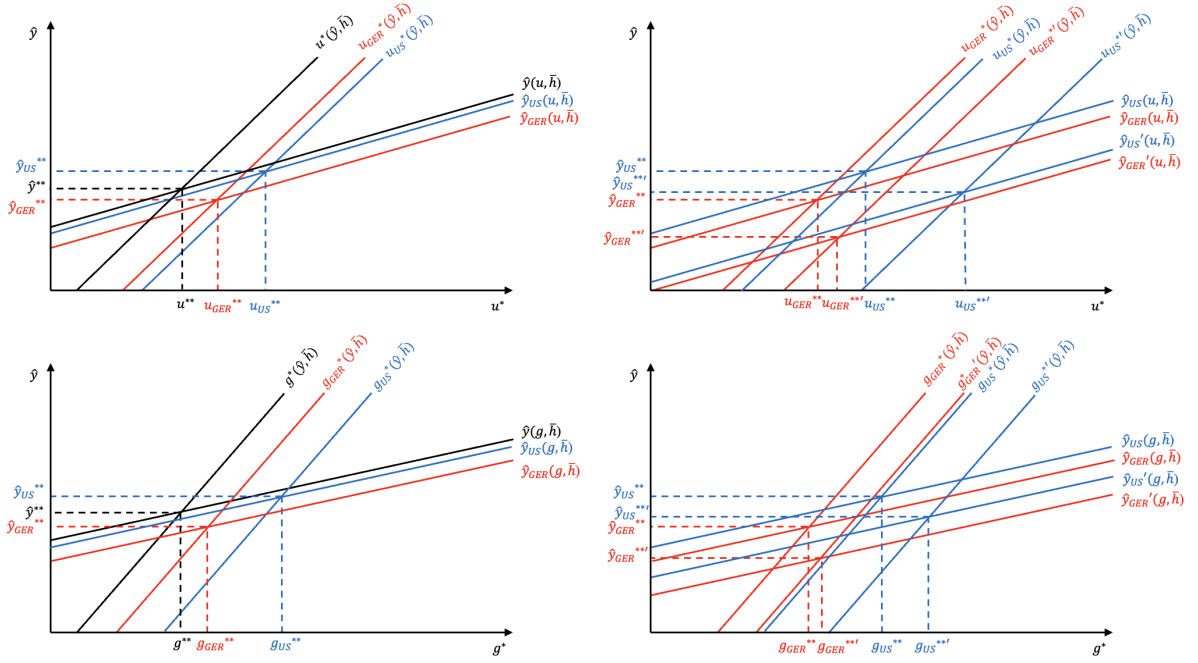
The comprehensive inclusion of this institutional forms into the classification of the productivity regime remains open for future research.

In the end, we can classify Germany as *labor-led productivity regime* with a strong reliance of the wage-labor nexus, while in the US a *state-led productivity regime* dominates with an active state. Both regimes encompass Keynesian elements of economic policy – Germany in the area of redistribution, the US regarding public investment – what strengthen their development to some extend. However, their main approach to economic growth is one associated with the 'neoliberal' turn with poor consequences for productivity growth.

We can now insert these productivity regimes in the full model of **??**. Figure 4.2 depicts the overall effects in Germany and the US departing from a common starting point corresponding to the economic situation before the here analyzed period. Of course, there were serious differences between the two economies even before the observed period, but the start with a common point shows the divergent development of Germany and the US and we are therefore retaining this for the sake of simplicity. Thus, we can only interpret Figure 4.2 in terms of development, not the levels of respective variables. We then compare the development over the course of the observed period divided by the GFC. Figure 2a depicts the pre-GFC period, while Figure 2a the one post-GFC. In doing so, we embed the insight of Germany's harsher decline in its productivity regime in the interplay with the demand regime and can thus ultimately derive the overall effects. Productivity growth started from an average level of annual growth of 2.91% in Germany and 1.35% in the US in the period 1973–1991 (OECD, 2024d).

Generally, we observe a rising profit share for Germany and the US. At first sight, this suggests that these wage-led economies must have experienced contractive demand regimes. However, post-Keynesian research argues that the wage- vs. profit-led debate only concerns the effect of income redistribution while the demand regime is also subject to changes in other components of demand. Thus, depressive demand effects via redistribution in favor of profits can be offset, for example, by implementing mercantilist strategies or debt-driven consumption (Hein & Martschin, 2021). Exactly this happened in Germany and the US respectively. Ultimately, we can assume an expansion of the demand regime in both economies, as we have seen in the data above to a different extend.

We have seen above that Germany's growth dynamics regarding utilization rates lag behind those of the US. This is evident in both the pre- and post-GFC periods, though more pronounced



(a) Development during pre-GFC period **(b)** Development during post-GFC period

Figure 4.2: Stylized long-run effects on capacity utilization, capital accumulation and productivity growth; Germany and the US

Notes: $\hat{y}$: productivity growth, u: capacity utilization, g: capital accumulation, h: profit share, x^*: goods market equilibrium of x, x^{**}: equilibrium of demand and productivity regime of x, $\overline{x}$: constant of x; x': post-GFC period. Black elements represent the common starting point, red elements the German development, blue ones that of the US. Country-specific economic deviation from the stylized common starting point before the analyzed period.
Source: Own depiction based on Hein (2014, ch. 8).

in the latter. In both periods, Figure 4.2 depicts a German demand regime in terms of capacity utilization that increases less than that of the US, particularly in the post-GFC period. Meanwhile, the productivity regimes of Germany and the US decline due to changes in distribution. Specifically after the GFC, there is a redistribution in favor of profits. However, changes in demand counteract these tendencies and result in a cushioned decline in productivity growth through the Verdoorn effect. This is especially true in the US where stronger growth in capacity utilization and, ultimately, output even leads to an increase in productivity growth in the pre-GFC period, starting from a productivity growth rate of 1.35% before. The contractive productivity regime is outweighed by a strongly expansive demand regime before negative effects take over in the post-GFC period, leading to a decline in productivity growth also in the US. Ultimately, productivity growth in regime equilibrium is constantly higher in the US than in Germany, and the same applies to the goods market equilibrium in terms of capacity utilization.

Defining the demand regime in terms of the capital accumulation rate does not change the picture in Figure 4.2. We still see expansive demand regimes in both economies, in the US on a higher

level. The goods market equilibrium defined in this way grows more in the pre-GFC than in the post-GFC period in Germany and the US. We depict the same cushioned development of declining productivity growth as in terms of capacity utilization.

These insights are in line with the stylized model by Hein (2023a, ch. 8.4) analyzing the shifts in DLPD and ELM regimes in the course of the GFC. There, government deficits stabilized demand in DLPD regimes and the utilization rate remains stable. Capital accumulation is weak in both the DLPD and the ELM regimes. We see this here in the example of Germany and the US. The US as DLPD and later DDL economy remain stronger after the crisis regarding utilization rates, while ELM Germany struggles to keep up. Meanwhile, both economies experience declining capital accumulation rates, in Germany on a lower level. These expansive demand regimes with progressively lower growth rates are no longer able to counteract the already contractionary productivity regimes. This explains the simultaneous trend of declining productivity growth and weak but existing growth in the goods market equilibrium defined in terms of capacity or accumulation.

This brings us to the last consideration. The Verdoorn coefficient is probably the most robust effect shown for various economies including Germany and the US (see e.g., Hein, 2014, ch. 8.3). As shown in section 2 the US has consistently higher output growth than Germany. Theoretically, this explains part of the higher productivity growth. Empirically, we find this channel for Germany but not for the US. However, the latter could be related to the year to year analysis and a cyclical relationship between both variables. Nevertheless, in vein of the cumulative causation between output and productivity growth, the effects of demand continue to be crucial in economic development. This does not contradict the institutional view proposed here. They complement each other. As shown above, all the institutional variables have an effect through the demand regime promoting a post-Keynesian policy mix of demand management that considers the long-run effects of short-term action.

5 Conclusion

To explore the possibilities of including variations of productivity regime in the growth regime framework, we built a post-Keynesian model of endogenous technical change and refined it with the institutional notions of Régulation Theory. There are various channels through which institutions – as a reflection of class struggle – affect productivity growth. Crucially, we iden-

tified the wage and the demand channel. Besides acting through them, institutions have direct effects on the innovative environment. In this paper, we have designed a theoretical framework allowing for the differentiation between direct and indirect effects.

In applying this framework to Germany and the US in the period between 1991 and 2022, we have tested our approach and show that it produces insights exploitable for post-Keynesianism and the CPE discipline. We classify the partial productivity regime of the ELM growth regime Germany as labor-led and the one of the DLPD, later DDL growth regime US as state-led. This distinction can explain why the German productivity growth declined even more than the US rates in a similar global climate of falling demand and wage shares. Deregulation strikes at the core of the German economic approach, while public investment stabilizes productivity growth in the US.

Nevertheless, future research should tackle various limitations of the theoretical scope of this paper. First of all, sectoral change from manufacturing to service industries enters the picture at some points but remains vague and there is no real theory of this change present. Furthermore, the figures for productivity growth in the US are questionable as the main ideas conveyed here in the Verdoorn relationship apply to manufacturing. This problem is mirrored in the empirical part by using data on capacity utilization derived from survey in manufacturing what makes the paper consistent but nevertheless too narrow. Lastly, finance – especially important for the US – resists the categories used here. There is no theoretically justified argument about the character of innovation in finance. Lastly, the empirical strategy of this paper can only be seen as first step to a more thorough analysis. It mostly lacks sufficient significance levels and there are various data challenges that we leave for future research.

Future policy should acknowledge the productivity effects of social institutions. The supply side is in the long run determined by demand and distribution. Policies of deregulation and austerity trigger long-run vicious circles. Germany and the US are examples for that. They do the bare minimum to safeguard some macroeconomic measures but do not implement a comprehensive framework to share the gains of production equally. Maybe it is time for a *real* change in the mode of regulation.

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Appendix

Derivatives of the Overall Long-Run Equilibrium

Following Hein (2014, ch. 8), changes in the profit share have the following effect on the respective variable ceteris paribus.

Capacity utilization:

$$\frac{\delta u^{**}}{\delta h} = \frac{\tau - \theta\omega - (s_\Pi - s_W)\frac{u}{v} + \psi\frac{\delta e^r}{\delta h}}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \tag{13}$$

An increasing profit share affects capacity utilization positively through investment and net exports, and negatively through consumption and productivity growth.

Capital accumulation:

$$\frac{\delta g^{**}}{\delta h} = \frac{(\tau - \theta\omega)\left\{[s_W + (s_\Pi - s_W)h]\frac{1}{v} + \phi\right\} - (\beta + \omega\rho)(s_\Pi - s_W)\frac{u}{v} + (\beta + \omega)\psi\frac{\delta e^r}{\delta h}}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \tag{14}$$

Again, redistribution towards profits increases capital accumulation through investment and net exports and decreases it via consumption and productivity growth. In the case of capital accumulation, feedback effects of demand and productivity growth must be considered.

Productivity growth:

$$\frac{\hat{y}^{**}}{\delta h} = \frac{\rho[\tau - (s_\Pi - s_W)\frac{u}{v} + \psi\frac{\delta e^r}{\delta h}] - \theta\left\{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi]\right\}}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi - \omega\rho} \tag{15}$$

The direct effect of a profit share increase on productivity is distinctively negative represented by the second term of the numerator. The overall direction of the effect of changes in the profit share depends on the demand regime. If the demand regime is wage-led, the effect of the goods market activity is negative in case of a rising profits share and the productivity effect is uniquely negative. For a profit-led demand regime different effects can arise described in **??**.

Data Sources

Description and calculation of variables

Name	Unit	Description/Calculation	Source
Macroeconomic variables			
Output	Billion 2015$	Real GDP in US dollars, PPP converted and chain linked volume with base year 2015	OECD (2024c)
Output per capita	2015$	GDP per person, PPP converted and chain linked volume with base year 2015	OECD (2024c)
Productivity growth	%	Annual difference of constant GDP per hour worked divided by GDP per hour worked	OECD (2024d)
Profit share	%	100 minus the adjusted wage share in current market prices	AMECO
Capacity utilization	%	GDP in constant prices divided by potential GDP	AMECO
Capacity utilization, survey	%	Seasonally adjusted rate of capacity utilization in manufacturing according to business surveys. Quarterly and monthly data aggregated by average.	OECD (2024a)
Capital accumulation rate	%	Growth rate of net capital stock in national currency	AMECO

Description and calculation of variables

Name	Unit	Description/Calculation	Source
Net export share	%	Net exports in current national currency divided by GDP in current national currency	AMECO
Indicators			
Union density	%	Proportion of employees who are members of a trade union among all employees	ICTWSS
Adjusted bargaining coverage (AdjCov)	%	Proportion of employees covered by collective agreements in force among employees with the right to bargain as derived from survey data	ICTWSS
Employment Protection Legislation, regular (EPL_r)	Index	EPL_r index evaluates regulation of workers' dismissal with regular contracts, covers individual and collective dismissals. Version 1 used	OECD (2021)
Employment Protection Legislation, temporary (EPL_t)	Index	EPL_t index evaluates regulation on dismissals and the use of temporary contracts. Version 1 used	OECD (2021)

Description and calculation of variables

Name	Unit	Description/Calculation	Source
Patents	%	Change rate of number of patent applications to the IP5 patent families, inventor's country of residence, priority date	OECD (2023)
Market concentration, Germany	%	Market share regarding value added of the largest 100 German companies. For regressions, missing values are added by taking the average of previous and following value	MK TOP
Market concentration, US	%	Market share calculated with share of revenues of largest 100 US companies in relation to nominal GDP	Fortune (2024) & AMECO
Public investment (PubI)	%	Governmental gross fixed capital formation as percent of GDP	AMECO
Social expenditure (SocEx)	%	Social transfers in kind as percent of GDP	AMECO
Controls			
Manufacturing share (Mshare)	%	Employment in manufacturing divided by total employment	AMECO

Description and calculation of variables

Name	Unit	Description/Calculation	Source
Gap	%	Difference in GDP per hours worked between US and Germany	OECD (2024d)

Notes: AMECO is European Commission (2023), ICTWSS is OECD and AIAS (2023), US Census is U.S. Census Bureau (2020), MK CR is Monopolkommission (2022b), and MK TOP is Monopolkommission (2022a)

Correlation Matrices

Correlation matrices, Germany and the US

	h	u	EPL_t	AdjCov	ΔPatents	Con	PubI	SocEx	Mshare	Gap
Germany										
h	1.00	0.05	-0.75	-0.40	-0.59	-0.35	-0.65	-0.16	-0.50	-0.66
u	0.05	1.00	-0.06	-0.25	-0.50	0.09	-0.00	-0.05	-0.09	0.18
EPL_t	-0.75	-0.06	1.00	0.79	0.75	0.52	0.71	-0.24	0.85	0.63
AdjCov	-0.40	-0.25	0.79	1.00	0.75	0.75	0.30	-0.71	0.98	0.27
ΔPatents	-0.59	-0.50	0.75	0.75	1.00	0.51	0.51	-0.20	0.72	0.43
Con	-0.35	0.09	0.52	0.75	0.51	1.00	0.21	-0.69	0.75	0.04
PubI	-0.65	-0.00	0.71	0.30	0.51	0.21	1.00	0.25	0.36	0.41
SocEx	-0.16	-0.05	-0.24	-0.71	-0.20	-0.69	0.25	1.00	-0.68	0.22
Mshare	-0.50	-0.09	0.85	0.98	0.72	0.75	0.36	-0.68	1.00	0.39
Gap	-0.66	0.18	0.63	0.27	0.43	0.04	0.41	0.22	0.39	1.00
US										
h	1.00	-0.33		-0.86	-0.07	0.66	-0.38	0.20	-0.88	
u	-0.33	1.00		0.04	-0.02	-0.44	-0.39	-0.68	0.27	
EPL_t			1.00							
AdjCov	-0.86	0.04		1.00	0.26	-0.68	0.48	-0.17	0.95	
ΔPatents	-0.07	-0.02		0.26	1.00	-0.25	-0.09	-0.31	0.30	
Con	0.66	-0.44		-0.68	-0.25	1.00	0.05	0.64	-0.80	
PubI	-0.38	-0.39		0.48	-0.09	0.05	1.00	0.67	0.24	
SocEx	0.20	-0.68		-0.17	-0.31	0.64	0.67	1.00	-0.44	
Mshare	-0.88	0.27		0.95	0.30	-0.80	0.24	-0.44	1.00	