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Working Paper

Modern Climate Policy: Moving beyond the market-liberal paradigm

Working Papers, No. 01/2023

Provided in Cooperation with:

Forum New Economy, Berlin

Suggested Citation: Krebs, Tom (2023) : Modern Climate Policy: Moving beyond the market-liberal paradigm, Working Papers, No. 01/2023, Forum for a New Economy, Berlin

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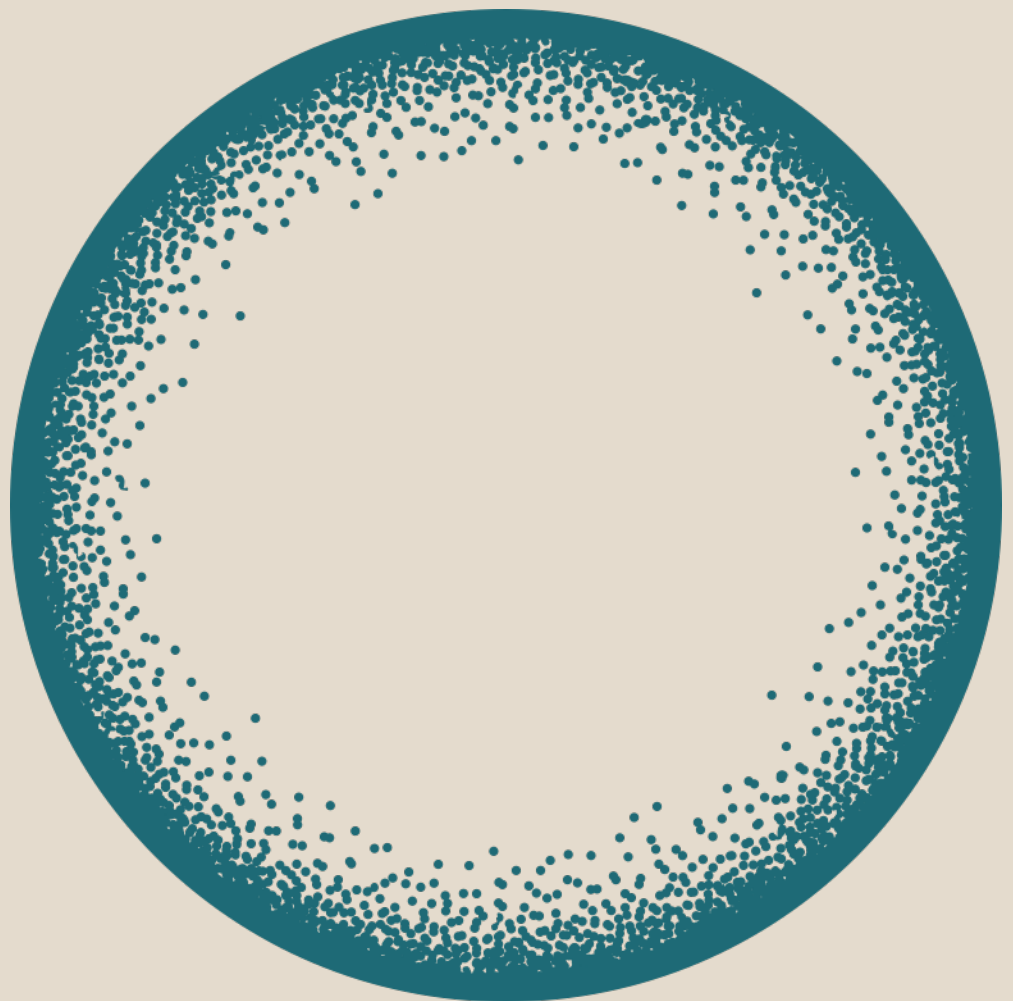
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NO. 01
2023

Working Papers

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Tom Krebs



Impressum:

Forum New Economy Working Papers

ISSN 2702-3214 (electronic version)

Publisher and distributor: Forum for a New Economy

Neue Promenade 6, 10178 Berlin, Germany

Telephone +49 (0) 30 767596913, email press@newforum.org

Lead Editor: Thomas Fricke

An electronic version of the paper may be downloaded

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MODERN CLIMATE POLICY: MOVING BEYOND THE MARKET-LIBERAL PARADIGM

Tom Krebs*, University of Mannheim**

Abstract

Traditional climate policy is based on the market-liberal paradigm that relies on carbon pricing, a belief in self-regulating markets, and transfer payments for the so-called “losers” of the transformation process. The market-liberal approach to climate policy is certain to fail because it is based on a two-fold theory of society that is far removed from reality: it neglects adjustment costs in the transformation process and also economic power relations in the labor market. In contrast, modern climate policy takes into account these features of real societies and delivers green and inclusive economic growth. This policy is built on the idea of a forward-looking government that creates “pro-worker green institutions” and uses a “pro-worker green industrial policy” to support people and companies in the transformation process. The US Inflation Reduction Act (IRA) is an example of a modern climate policy in the sense that it includes several elements of a pro-worker green industrial policy. However, the US currently lacks the institutional structure to successfully implement a pro-worker climate agenda. European countries should embrace the general US approach to climate policy and develop their own, improved version based on their individual and institutional strengths.

JEL codes: D52, J50, J64, L32, L50, O43, O44, Q43, Q50

Keywords: Climate Policy, Pro-Worker Green Industrial Policy, Pro-Worker Green Institutions, New Paradigm

* I thank the team of Forum New Economy for helpful comments and discussions.

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1. INTRODUCTION

Climate neutrality has become the consensus view in world politics. Transforming the current economic system into a green economy requires a fundamental change in the way the entire world produces and consumes. To manage this great transformation of the 21st century successfully, policy makers often seek advice from economic experts. When asked about the right type of climate policy, many economists have a relatively simple method to offer.

This economic policy prescription is based on a market-liberal view of society in the tradition of “economic liberalism” (Hayek, 1960). It consists of three main elements: first, using carbon pricing as the central policy instrument causes individuals to pay for the environmental cost of their behavior; second, trusting the market and believing in price signals leads to an efficient coordination mechanism; and third, using transfer payments to compensate for the so-called “losers” of the transformation process leads to climate neutrality.

In this paper, I argue that the market-liberal approach is bound to fail because it is based on a theory of the economy that is far removed from reality. Specifically, the market-liberal theory neglects the complexity of the transformation process that entails individual adjustment costs and uncertainty. In other words, market liberalism creates the fictitious commodities of “land” (nature) and “labor” (humans), assuming that they can adjust smoothly to changing economic conditions, and therefore counterfactually assumes the possibility of disembedding the economy from society (Polanyi, 1944).¹ In addition, market-liberal theory downplays the economic importance of power relationships and therefore counterfactually assumes that the question of production can be cleanly separated from the question of distribution (Marglin, 1984).

The market-liberal approach to climate policy is not only empirically flawed, but it also has the disadvantage of offering a rather depressing narrative. In the world of market-liberal economists, the main instrument to make people engage in climate-friendly behavior is to punish them for climate-unfriendly behavior. Further, the social dimension is reduced to transfer payments for the so-called “losers” of the transformation process. Clearly, most people do not enjoy punishment, they do not want to receive government handouts, and they certainly do not want to be called losers. In general, people want decent, well-paying jobs in a green economy and governments that support them in securing these types of jobs.

Of course, market-liberal economists have one positive story to tell, but it is more of a fairy-tale that has lost its credibility. Specifically, most market-liberals are strong believers in the existence of a “market-fairy” (price signals) that magically ensures a smooth and costless transition to a green

¹ Polanyi (1944) introduces a third fictitious commodity, “money”. In this paper, I do not address the role of financial markets and money in the modern approach to climate policy, since the topic is important enough to require a paper of its own.

economy. It is important to state that there is nothing wrong with a good fairy-tale illuminating a theory that holds up to the empirical evidence. However, the story of magic market forces has been told rather too often during the process of rapid globalization and deregulation, with the outcome that the results of this transformation process have disappointed many workers in the US and Europe. It is highly unlikely that people will be fooled a second time by market-liberal economists overplaying their hands.

The failure of the traditional climate policy does not mean that economics has nothing to offer to policy makers. Indeed, there is a substantial body of work in the economics literature that can, in principle, be used to design an alternative, more realistic approach to climate policy. This alternative approach takes into account complexity and market power, and provides the foundation for a modern version of climate policy that will support a just transition to a green economy.

In this paper, I will outline the main components of such a modern approach to climate policy. The approach has already been adopted by some policy makers, but it still faces fear-led resistance by market-liberal economists and politicians who, sometimes unknowingly, echo market-liberal ideas. The objective of this paper is to show how the different pieces fit together to define a new policy paradigm that is superior to the old paradigm, both in terms of its empirical validity and its ability to bring about a successful transformation.

A modern climate policy is a set of government policies and institutions that support people and companies in the transformation process to a green economy that can provide prosperity for all people.² In other words, modern climate policy aims at generating green and inclusive economic growth, and rests on two key pillars.

The first pillar is a permanent expansion of public investment in people, innovative companies, and green infrastructure. This part of modern climate policy is similar to the *Green New Deal* (*Green European Deal*), and it entails important elements of a *Green Industrial Policy*. However, it also includes a strong pro-worker element, which makes it a *Pro-Worker Green New Deal*, respectively a *Pro-Worker Green Industrial Policy*. The first pillar of modern climate policy enhances the opportunities for people and businesses to thrive and provides the foundation for a technology-driven, just transition to a green economy. In economic terms, it consists of a set of government policies that reduce adjustment costs and uncertainty in the transformation process.

The second pillar of modern climate policy is a set of rules and regulations that ensure a level playing field in the market for land and labor; that is, the creation of pro-worker green institutions. In a certain sense, the second pillar of modern climate policy is an application of the general ideas of Social Liberalism applied to the markets for land and labor in a modern society. This second pillar

² Notice that modern climate policy places the emphasis on rewarding people and companies for “good” behavior (“carrots”), whereas traditional climate policy focusses on punishing people and companies for “bad” behavior (“stick”).

creates the conditions for a pro-worker green industrial policy to work and provides the foundation for a successful transition to a green, good-jobs economy. In other words, pro-worker green industrial policy (pillar one) and pro-worker green institutions (pillar two) are complementary government decisions that reinforce each other.

The following table summarizes the main elements of modern climate policy (the new paradigm) discussed in this paper and contrasts them with the corresponding policy instruments of the traditional climate policy approach (the old paradigm).

Old Paradigm	New Paradigm
Minimal Government Intervention	Pro-Worker Green Industrial Policy
Punish climate-unfriendly investment through carbon pricing	Support green private investment through targeted subsidies
Provide transfer payments for the “losers” of the transformation process	Support investment in workers through apprenticeship and training programs
Trust the market to increase green investment	Expand green public investment
Trust the market to increase wages	Make subsidies and public contracts conditional on good pay to boost wages
Deregulation and Privatization	Pro-Worker Green Institutions
Disestablish unions and prevent workers from organizing disruptive unions	Support labor organizations (unions, work councils) that offer workers a voice
Trust the market to increase wages	Use minimum-wage laws to boost wages in sectors not covered by collective bargaining
Privatize education and worker training	Provide a system of public education and public apprenticeship/training programs
Privatize public companies	Provide the foundation for green public investment by creating public companies

In the last part of the paper, I use the modern perspective of climate policy to discuss the Inflation Reduction Act (IRA), which was recently enacted by the Biden Administration White House, 2022a). The IRA includes several elements of a pro-worker green industrial policy and clearly goes beyond

the market-liberal paradigm (White House, 2022b). European leaders should therefore not fight the IRA but rather embrace it and implement an improved European version of the IRA.

Though the general approach of the Biden Administration to climate policy is sound, it has one major flaw when it comes to implementation. Specifically, the US lacks the labor institutions that are necessary to translate a pro-worker government agenda into actual pro-worker policy. In other words, the IRA includes several elements of the first pillar of modern climate policy, but the US has major institutional weaknesses that are part of the definition of the second pillar of modern climate policy. As discussed here, these institutions include well-organized unions, work councils, and minimum-wage laws that are necessary to break the structural power asymmetry in the labor market and provide workers with a voice. Clearly, many EU countries have an edge vis-a-vis the US when it comes to these types of institutions, and they should use it to their advantage.

There are three areas where a European pro-worker climate agenda is particularly promising. First, the IRA tries to boost wages by providing a bonus credit that applies to employers who pay “prevailing wages”, however the concept of a “prevailing wage” is somewhat unclear and difficult to enforce in the US where there is little collective bargaining and union coverage. In contrast, in most EU countries, wages in the industrial sector are covered by collective bargaining agreements and union wages can be easily used as benchmarks in various sectors. Further, an integral part of any modern policy agenda must be the training of workers for new jobs in the future green economy. Germany and some other EU-countries have a long tradition of using apprenticeship and re-training programs that support workers in acquiring the technical skills needed for most industrial jobs.

Finally, one shortcoming of the industrial policy is that it will do little to boost wages in the low-wage segment of the service sector. This is the reason why minimum-wage laws are essential for any pro-worker policy agenda, and EU countries should use the opportunity to reach the common goal of achieving an adequate minimum wage that is fair and provides a decent standard of living (European Commission, 2022). For example, the German government has recently raised the minimum wage from 10.35 Euro to 12 Euro (about 16 US dollar in PPP exchange rates), which is an important step towards a fair minimum wage. However, a large part of this minimum-wage hike will be “eaten up” by high inflation in 2022 and 2023. To be in line with the EU declaration on minimum wages, the German minimum wage needs to be raised to at least 14 Euro (about 19 US dollar) as soon as possible.

2. GREAT TRANSFORMATION OF THE 21ST CENTURY

This section discusses the considerable challenges that societies face and defines the corresponding mission for policy makers. The mission comprises three goals: climate neutrality (green economy), prosperity (strong economy), and social justice (just economy). In other words, the mission for policy

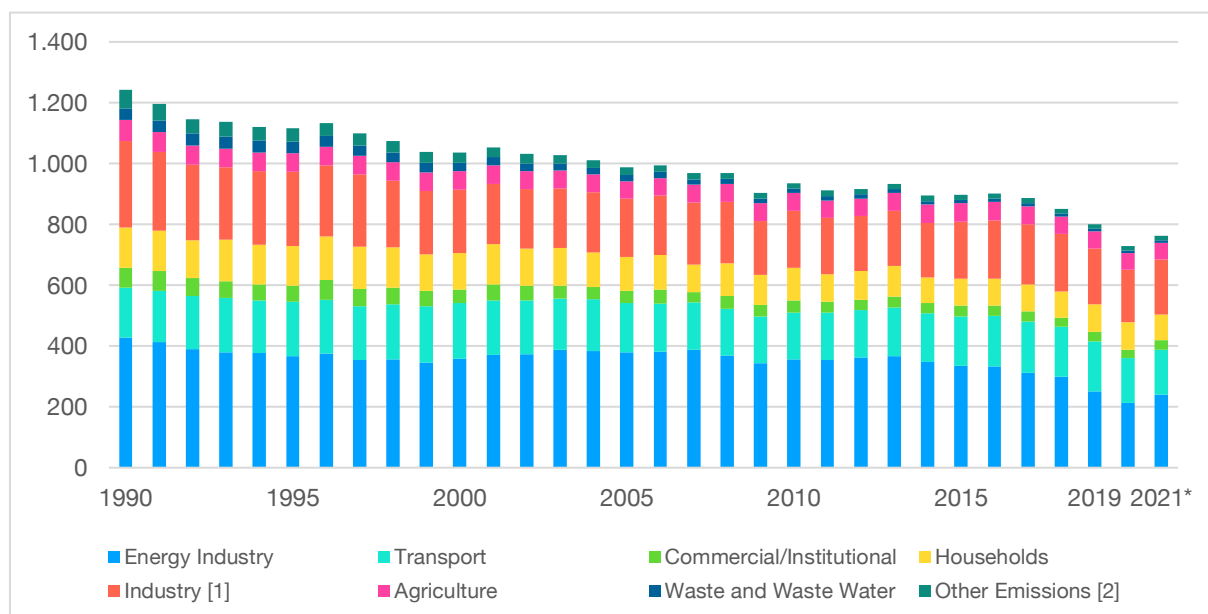
makers is to generate green and inclusive economic growth so as to achieve a successful transformation of the economy.

2.1. Green Economy (Sustainability)

Climate neutrality -- an economy with net-zero greenhouse gas emissions -- has become the consensus view in world politics. The Paris Agreement on global climate actions negotiated in 2015 was one of several political decisions and agreements that have the transition to a climate neutral (green) economy as the common goal. Specifically, the EU aims to be climate-neutral by 2050 and has taken concrete steps towards achieving this goal with its “Fit for 55” and “European Green Deal” policy programs (EU, 2022). Further, Germany has set itself the goal to be climate neutral by 2045 (BMWK, 2022a).

Figure 1 depicts the carbon gas emission in Germany over the last 30 years. The figure shows that substantial progress has been made in the last 30 years, whereby emissions have been reduced from 1,242 million ton of CO₂-equivalents in 1990 to 762 million ton of CO₂-equivalent in 2020. This amounts to a reduction by 39 percent. However, to achieve climate neutrality by 2045, Germany needs to reduce carbon gas emissions even further to 438 million ton of CO₂-equivalent, which amounts to a reduction of 43 percent between 2021 and 2030. As this paper argues, it will be possible to achieve this highly ambitious goal, but only if the German government goes beyond the policy advice of mainstream economists and implements a bold policy plan to support the transition to a green economy. Section 4 describes the main pillars of such a policy plan.

Figure 1: Emission of Greenhouse Gases since 1990 [in Million Tons of CO₂ Equivalents]



Source: German Environmental Agency (Umweltbundesamt); Emissions by UN reporting category, without land use, land use change, and forestry.

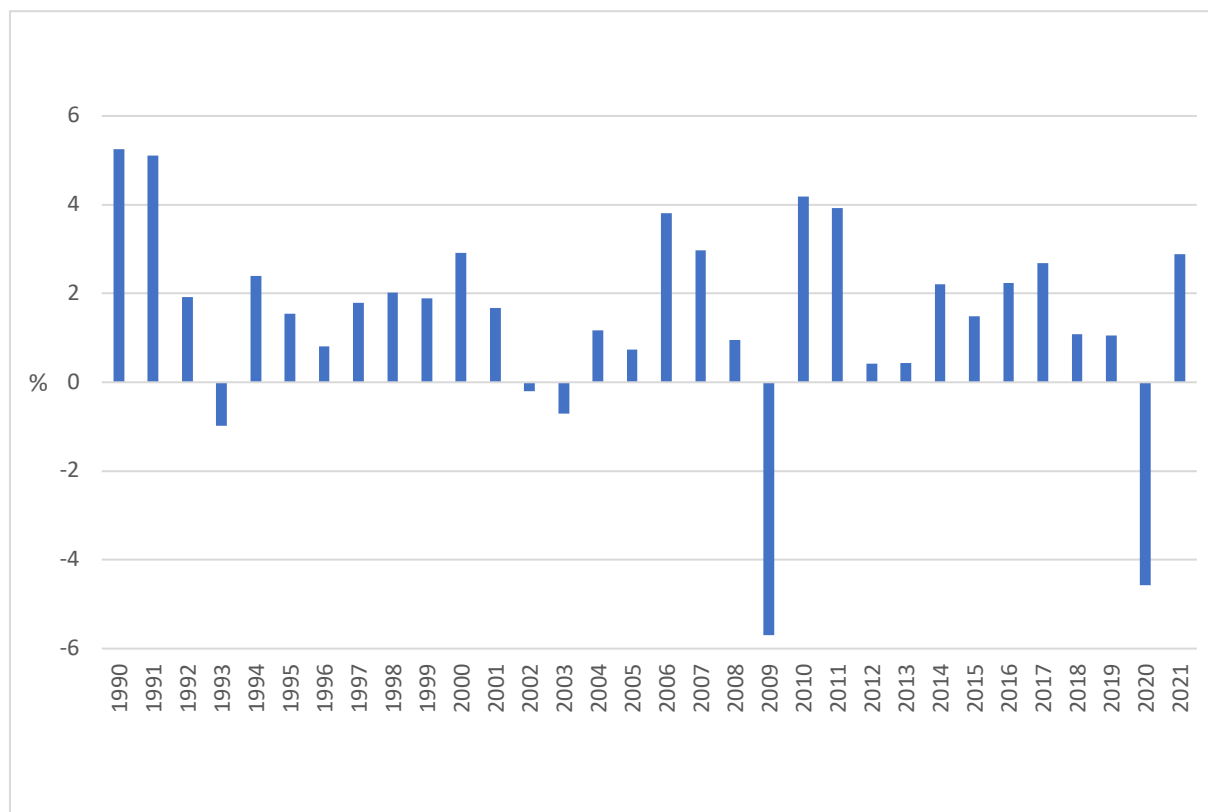
This paper focuses primarily on climate neutrality. Indeed, the question of sustainable development in line with the planetary boundaries is much more complex. A simple way of visualizing this complexity is the doughnut economy introduced by Kate Raworth (2012). In a certain sense, by focusing on climate neutrality the current paper simplifies a multi-dimensional ecological problem into a one-dimensional problem. Clearly, this simplification needs to be kept in mind when interpreting the results.

An alternative approach to setting climate targets is to assign each country with a carbon budget, which is derived from a global carbon budget assumption of how this global budget ought to be distributed among countries. Using this point of view, reaching climate neutrality by 2045 is not enough for Germany, since Germany has only a very small carbon emission budget in reserve (Helmholtz, 2021). Thus, advanced economies like Germany usually receive a relatively modest budget because these economies have already produced a substantial amount of carbon emissions in the past. In this paper, the analysis only covers the policy tools necessary for achieving carbon neutrality by 2045. If a more ambitious goal is to be achieved, policy steps are required that go beyond those discussed in this paper.

2.2 Strong Economy (Prosperity)

The economic approach to measuring prosperity is based on the concept of (real) gross domestic product (GDP): the inflation-adjusted value of all goods and services produced within a country (Germany) within a certain period of time (year). Figure 2 depicts the annual growth rate of GDP for Germany from 1990 to 2021. The average growth rate in these 31 years was 1.4 percent. Germany experienced very strong economic growth directly after reunification, with a maximum growth rate of 5.2 percent in 1991. Germany has also gone through four recessions since 1990 (where economic growth rates are negative, and GDP is shrinking for at least two quarters). Specifically, GDP declined by 5.7 percent in 2009 as a consequence of the Global Financial Crisis (GFC 2008-2009) and by 4.6 percent in 2020 during the Covid-19 crisis.

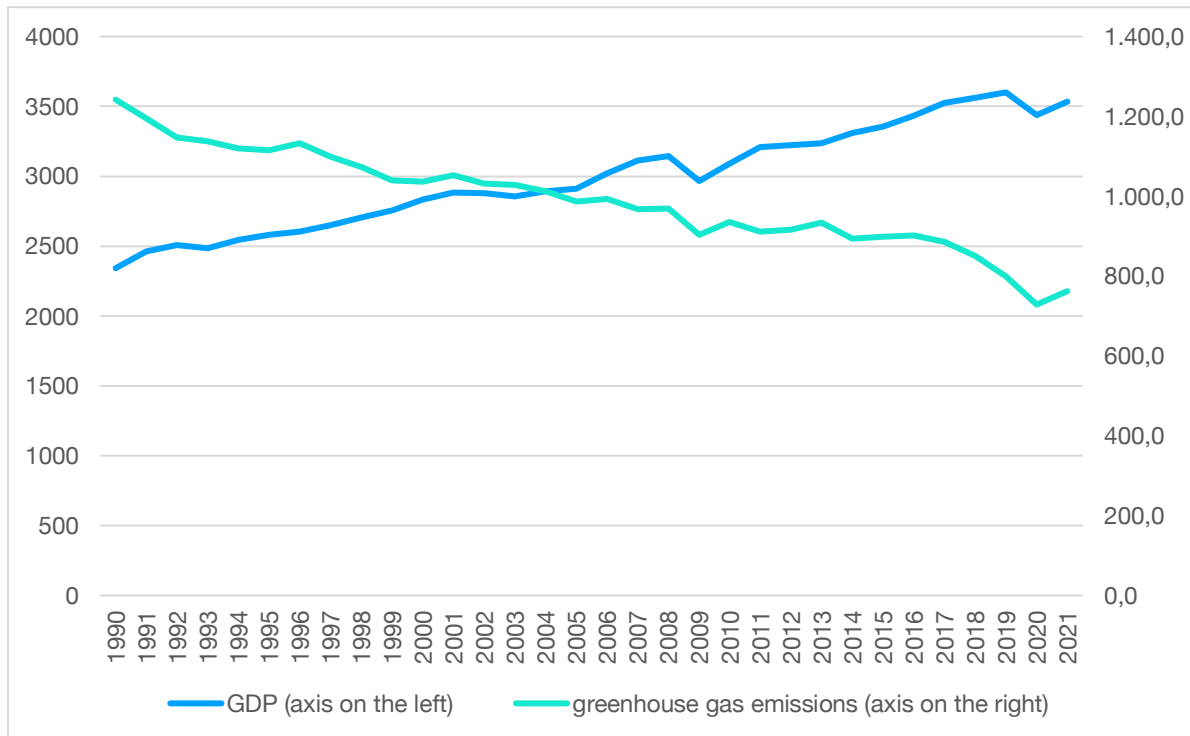
Figure 2: Annual Real GDP Growth Rates [in percent]



Source: German Statistical Office (Statistisches Bundesamt)

Figure 3 shows the development of the GDP level and the development of carbon emissions from 1990 to 2021. The figure shows that during this period Germany managed to achieve “decoupling”; that is, economic growth is increasing prosperity while CO₂ emissions are falling. Of course, the figure also shows that the degree of decoupling has to increase substantially if Germany wants to meet its climate targets. In other words, Germany needs to implement a much more ambitious climate policy than it has adopted in the past if climate neutrality by 2045 is to be achieved.

Figure 3: Emission of Greenhouse Gases [in Million Tons of CO₂ Equivalents] and Real GDP



Source: German Statistical Office and German Environmental Agency

GDP is an imperfect measure of well-being and the functioning of a society. This is the reason why many countries have expanded GDP accounting to include environmental and social dimensions. In 2022, Germany followed suit and the Federal Ministry for Economic Affairs and Climate Action included in its annual economic report a chapter on inclusive and sustainable prosperity (BMWK, 2022b).

2.3 Just Economy (Equality)

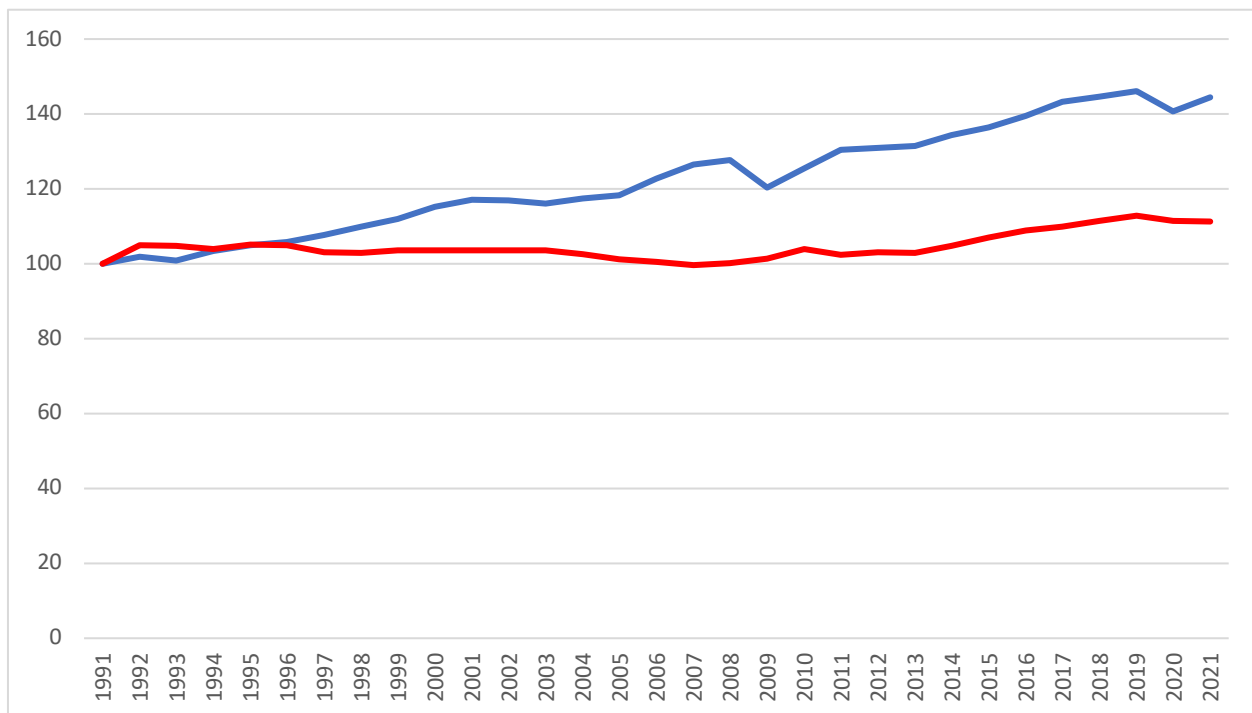
In this paper, the basic idea of a just economy is that everybody has a fair chance to participate in the production process in a rewarding way. Of course, reasonable people can disagree about the meaning and definition of the concepts “fair chance” and “rewarding way”. In addition, even if there is agreement in principle, there is still the issue of how to measure these concepts in practice. It is therefore not too surprising that neither economics nor political philosophy can provide simple answers to the question of the meaning of a “just economy” or a “just transition” to a green economy.

Suppose we use market income as a proxy for what it means for participation in the production process to be “rewarding” and use the inequality of market income, respectively the lack thereof, as a way of measuring a “fair chance”.³ In this case, that several advanced economies like the US and Germany have become less fair in the period 1990 – 2021 in the sense that market income inequality

³ Clearly, observed market income is the outcome of a combination of opportunity, individual effort, and luck, and an observed increase in income inequality can be the result of an increase in inequality of any of these three factors. The effect of luck can be minimized by using (expected) lifetime income.

has increased, although the timing and extent of the rise in inequality depends on the statistical measure of inequality (Bach et al., 2021). However, it is undisputed that real wages (labor income) of the majority of workers have increased much less than GDP (see Figure 4 below). In other words, over the last 30 years, we have witnessed a substantial economic increase in the quantity and quality of goods and services produced, while the majority of workers have barely benefitted from this increase in general prosperity.

Figure 4: Real GDP (blue line) and Real Wages (red line)



Source: German Statistical Office

3. TRADITIONAL CLIMATE POLICY

This section develops the main arguments and policy prescriptions of the market-liberal approach to climate policy. To this end, Section 3.1 discusses the central instrument of market-liberal climate policy: carbon pricing. Subsections 3.2 and 3.3 then introduce the Invisible-Hand Theorem, which provides the theoretical underpinning for the policy claims of market-liberal economists. Subsection 3.4 analyzes the market-liberal approach to deal with the social dimension of the transformation process: transfer payments for the so-called “losers”. Finally, Subsection 3.5 briefly discusses a recent policy development; that is, the emergence of “Green Ordo-Liberalism” which focuses on competition policy and the regulation of goods markets.

3.1 Market-Liberal Approach

In the public debate, the standard approach to climate policy is a market-liberal approach. It derives from two economic ideas that are closely connected to liberalism. First, a concept of freedom comes from the tradition of economic liberalisms and was eloquently described by Friedrich von Hayek in his book “The Constitution of Liberty” (Hayek, 1960). Central to Hayek’s concept of a liberal society is a market economy in which individuals and companies compete for the best ideas, thereby contributing to the enhancement of the social good. In such a “free” society, market prices signal relative scarcity and coordinate the individual decisions of millions of households and companies in a way that benefits all. Applying this market-liberal approach to climate policy, it implies a focus on individual responsibilities and climate-friendly innovations by profit-driven entrepreneurs who sell their products in the market place.

The second pillar of the market-liberal approach to climate policy is the notion that an individual’s own freedom should be constrained whenever one’s actions severely limits the freedom of others. From a liberal perspective, government interventions in the market economy are justified if there are externalities: the consumption or production of goods by one individual or company has a direct effect on the well-being or profit of another individual or company. In a situation with significant externalities, the reasonable behavior of individual actors does not translate into a desirable aggregate outcome and the state needs to intervene to restore efficiency and improve the social outcome.

Two types of externalities have dominated the public debate on climate policy. Accordingly, traditional climate policy only requires a degree of trust in market forces and two policy instruments:

- A common price for carbon emissions to ensure that market prices reflect the climate cost of individual behavior; and
- A public subsidy for the research and development of clean energy to provide private companies with additional incentives for green innovations.

Both policy instruments have a simple economic rationale. First, a price on carbon emissions is necessary to correct for the negative climate externality and is an effective instrument to reduce climate-damaging behavior. There is ample empirical evidence for this type of climate externality of individual behavior. Second, a subsidy for climate-friendly research and development activities is economically justified, since individual companies do not always take into account that their own research activities have positive spillover effects onto other firms. There is also considerable empirical support for the positive externalities in knowledge production (Bloom et. al., 2019).

The market-liberal approach to climate policy is the dominant position held by academic economists who engage in public debates. For example, according to the work of William D. Nordhaus, who developed the well-known DICE model (Dynamic Integrated Climate Economy) and

received the Nobel Prize in Economics in 2018,⁴ a carbon tax is the central policy instrument to fight climate change (Nordhaus, 2007). In January 2019, a large number of economists – among them 28 Nobel Laureate Economists and 15 chairs of the US Council of Economic Advisers – published a statement that proclaimed a carbon tax to be the best instrument to fight global climate change (Economists’ Statement, 2019b). In June 2019, the Policy Outreach Committee (POC) of the European Association of Environmental and Resource Economists (EAERE) followed suit and prepared a statement signed by over 1,700 economists that demanded a common carbon price (Economists’ Statement, 2019b). In Germany, the influential council of economic experts published in 2019 a special report on climate policy that put carbon pricing at center stage, mentioned public investment only in passing, and did not mention industrial policy at all (CEE, 2019). In addition, there are countless books on climate policy in which the efficiency of carbon pricing is the central theme.⁵ The first paragraph of the Economists’ Statement (2019a) aptly summarizes the essence of the argument in favor of a carbon price as the central instrument of climate policy:⁶

“A carbon tax offers the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary. By correcting a well-known market failure, a carbon tax will send a powerful price signal that harnesses the invisible hand of the marketplace to steer economic actors towards a low-carbon future.” (Economists’ Statement, 2019a)

The idea that prices in a market economy can coordinate the actions of millions of individuals leading to a socially desirable outcome goes back to Adam Smith and his invisible-hand analogy (Smith, 1776). In economics, the result is known as the First Welfare Theorem and its modern version was formulated and proved by Kenneth Arrow and Gerard Debreu in the 1960s, who won the Noble Prize in Economics in 1972 (Arrow) and 1981 (Debreu) for their work.⁷ This so-called Invisible-Hand Theorem result lies at the heart of modern economics and is central to arguments made by market-liberal economists in public debates. It is therefore essential to further explore and to discuss this result in more detail.

⁴ More precisely, the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.

⁵ For example, in his recent book on the economic approach to climate policy, Achim Wambach focuses on carbon pricing and the design of markets for renewable energy but downplays the importance of public investment and warns of government overreach (Wambach, 2022).

⁶ See also Greenstone and Nath (2021) for a concise statement of the centrality of carbon pricing in climate policy.

⁷ See Mas-Colell et al. (1995) for a standard textbook treatment of the welfare theorems. Neither one of the two can be considered a market-liberal economist. Indeed, Kenneth Arrow was quite critical of real market economies and their ability to generate efficient outcomes (Arrow, 1978).

3.2 Invisible-Hand Theorem

Consider the following economy analyzed in Golosev et al. (2014).⁸ Firms produce goods and services using three input factors: capital (machines), labor (workers), and energy (clean or dirty). The relationship between input factors used and goods produced is summarized by a neoclassical production function, and firms have the ability to substitute clean energy (solar, wind, water) for dirty energy (oil, gas, coal). Firms sell their products in perfectly competitive markets to consumers (consumption goods) and other firms (investment goods, energy). Firms hire labor/workers in a perfectly competitive labor market, where perfect competition implies that the real wage is equal to the marginal (revenue) product of labor. Workers supply their labor services based on a labor-leisure choice and use their labor income to finance consumption purchases. Firms are owned by capitalists who collect profits, make an investment choice, and consume what is left of profits after taxes are paid and investment costs are subtracted.⁹

An allocation is a specification of the quantities of factors used and the quantities of goods produced. A competitive equilibrium is an allocation and a list of prices (including the wage rate), so that all markets clear -- supply equals demand. Using equilibrium prices to calculate the value of all (final) goods and services, we can compute equilibrium GDP in the market economy. The First-Welfare Theorem, which will be called the Invisible-Hand Theorem in this paper, states the following.

Invisible-Hand Theorem. *If certain conditions are satisfied, then the equilibrium allocation of the market economy is Pareto efficient. Specifically, there is no alternative, feasible allocation that makes one group of workers/capitalists better off without making somebody worse off.*¹⁰ *Further, the equilibrium allocation of the market economy maximizes GDP (production efficiency of the market outcome).*¹¹

The phrase “under certain conditions” means that certain assumptions need to hold in order for the Theorem to be applicable; that is, there are no conclusions without assumptions. These assumptions specify the domain for which the conclusions apply, and they also delineate the cases in which the Invisible-Hand Theorem fails to hold. If at least one of the assumptions does not hold, economists broadly speak of a situation of market failure or market imperfection.

⁸ The model is a version of the well-known DICE (Dynamic Integrated Climate Economy). See Nordhaus (2007) for an exposition of the canonical model and Krusell and Smith (2022) for a recent survey of the literature on integrated climate models.

⁹ The model in Golosev et al. (2014) assumes that private households own capital and labor, that is, they are both capitalists and workers at the same time.

¹⁰ The feasibility constraint entails the aggregate resource constraint and the technology constraint encoded in the production function.

¹¹ Pareto efficiency implies production efficiency, but the reverse is generally not true.

There are different ways to list the set of assumptions that underlie the phrase “under certain conditions”. For the purpose of the current paper, the following list is the most useful:

Assumptions

- i) Individual rationality: People (workers and capitalists) have individual preference over outcomes and make choices that are in accordance with their individual preferences;
- ii) There are no externalities in preferences or production functions;
- iii) Non-convex adjustment frictions/costs and uninsurable risks (uncertainty) can be neglected; that is, there is an **absence of complexity**;
- iv) There is no natural monopoly in the infrastructure sector and there is no bargaining between capital owners and labor over production surplus; that is, there is an **absence of power**.

In this paper, the focus is on assumptions iii) and iv). Specifically, in Section 3, we argue that in reality these assumptions are not even approximately satisfied and that this therefore implies large inefficiencies of the market outcome. These inefficiencies are a result of fundamental market failures that can only be remedied if the government adopts a much more comprehensive approach to policy making than would be warranted, according to the market-liberal paradigm. In contrast, we adopt assumption i), which shows that the source of inefficiency discussed here is not driven by individual irrationality. Put differently, in this paper we analyze an aggregate irrationality that occurs despite people being individually rational.¹²

As mentioned before, externalities play a crucial role in traditional climate policy. In other words, assumption ii) does not hold. The extension of the Invisible-Hand Theorem to cases with externalities is discussed next.

3.3 Invisible-Hand Theorem with Climate-Externality

The standard approach to incorporating the negative climate externality into economic models goes back to Nordhaus (2007) and proceeds in two steps (Hassler et al., 2014). The first step specifies the relationship between the use of energy with carbon emission (gas, oil, coal) and the temperature rise due to carbon in the atmosphere. This part of the analysis is based on the non-economic literature on climate change. The second step postulates a link between temperature increase and economic damage in terms of GDP lost as a negative production externality: the use of “dirty” (emission-intensive) energy by production firms negatively affects the production of all firms. The relationship between temperature increases and economic damage is usually estimated from data on climate disasters such as hurricanes and other information. Alternatively, the literature has captured the negative impact of climate change through a negative effect on the preferences of households (Acemoglu et al., 2012).

¹² This means, among other things, that the somewhat paternalistic approach of “explaining to people” or “nudging” will not suffice to combat the aggregate inefficiency that is the topic of the current paper.

A modified version of the Invisible-Hand Theorem still holds when energy use leads to a negative environmental externality due to carbon emission:

Invisible-Hand Theorem with Carbon Emission. *Suppose there is a negative environmental externality due to carbon emission, but otherwise the assumptions discussed in the previous section are satisfied. Then the equilibrium allocation of the market economy with a common tax on carbon emission is Pareto efficient. Further, the equilibrium allocation of the market economy with a common carbon tax achieves maximal GDP (production efficiency).*

The Invisible-Hand Theorem with Carbon Emission constitutes the theoretical foundation of the traditional, market-based approach to climate policy that dominates the public policy debate. It calls for one policy instrument in order to rectify one market failure – a negative climate externality. Besides this one government instrument, no further government intervention is needed. In addition, the policy instrument is simple enough to implement since it only requires one tax for all sorts of activities and energy uses. In other words, a common carbon tax levels the playing field and the market will take care of the rest.

The simplicity of the market-liberal approach to climate policy partially explains the strong support for this type of policy among economists and the climate community. It is easy to convey in public debates by the often-heard phrase, “the central instrument of climate policy is the carbon price”. It also provides for a simple way of implementing a more ambitious climate policy; that is, simply demand a higher carbon price. Indeed, this is exactly what happened in Germany after the Constitutional Court ruled in 2021 that the German climate policy is not aligned with its stated climate goals.

Clearly, additional policy instruments are needed if additional externalities are at work. Specifically, when there is a negative externality in the use of dirty energies and a positive externality in the development of technologies for using clean energy, then the efficiency of the equilibrium allocation of a market economy can only be ensured with a carbon tax and a subsidy for research and development in clean energy (Acemoglu et al., 2012).

There are in principle two ways of implementing a carbon price: either through a carbon tax or through the trading of carbon permits. The tax-approach sets the carbon price directly and supply-and-demand conditions then determine the volume of carbon emissions endogenously. In contrast, the permit-approach directly sets the volume of emissions (permits) and supply-and-demand conditions then determine the carbon price endogenously.¹³

¹³ The idea that the government should not use a tax, but create a market to tackle an externality problem traces back to the contribution by Ronald Coase (1960).

The market-liberal approach, in general, favors the trading of permits since governments would presumably set the level of the carbon taxes incorrectly; indeed, the possibility of government failure is a recurrent talking point among market-liberal economists. For example, in Germany, the council of economic experts (SVR, 2019), as well as the influential Potsdam Institute of Climate Change (Edenhofer et al., 2019), strongly endorse using the ETS trading system for carbon pricing. The often-made argument that trading carbon permits is an efficient way of implementing carbon pricing neglects, however, financial markets, including the ETS trading system, often have the tendency to generate endogenous price volatility and excess price reactions to news about future fundamentals.

3.4 Social Policy

The Invisible-Hand Theorem claims the production efficiency of a certain type of market economy, but it is silent about the distribution of production. Specifically, an allocation can be Pareto efficient even if one group (for example, capitalists) receives most of the output produced as income and all other groups (for example, workers) receive only the minimum income necessary for subsistence. In terms of the green transition, the theorem lacks a statement about the social dimension of a green transformation. Specifically, it has nothing to say about how we can ensure that everybody benefits from the transition to a green economy, including, workers in a newly developing green-hydrogen industry, as well as workers in the care sector, for example.

The market-liberal approach has two answers to the social question. The first is a very simple idea: “trickle-down economics”. This answer would mean, for example, that we only need to wait and, with time, workers in the care sector will magically benefit from a green boom through rising wages. In the end, there are only winners since the invisible hand of the market will ensure a frictionless transformation to a green and just economy. The trickle-down approach has always lacked theoretical or empirical foundation. It also has lost much of its political support, specifically in Continental Europe.

The second answer of the market-liberal approach to the social question is based on the seemingly progressive concept that, in contrast to the trickle-down theory, does have a solid economic foundation. The approach relies on redistribution through direct transfer payments by the government and a progressive tax system in order to ensure a just distribution of the benefits of a green economic boom. Put differently, first we try to make the cake green, and then we set about distributing the cake: the question of economic growth can be neatly separated from the distributional question.

The second approach represents the dominant view in climate politics. It resembles the economic policy paradigm during the period of rapid globalization, when policy leaders suggested that so-called “losers” of international trade in economies like the US and Germany could be sufficiently

compensated using transfer payments. Clearly, the simple transfer-approach to the social dimension has not worked out well.¹⁴

3.5 Market Regulation

Thriving competition among firms is a central tenant of the market-liberal approach. The pressure of competition forces firms to innovate and to set prices reflecting costs. In contrast, market power leads to anti-competitive behavior and the loss of welfare. From this perspective, it is quite concerning that in the 1980s, mark-ups and profit rates started to rise sharply in the US for another four decades (Loecker et al., 2020). A similar trend has also been observed in Europe, although the increase is much less pronounced than in the US (Affeldt et al., 2021). This secular trend in mark-ups and measures of market concentration provide strong evidence that competition in the US and many European countries has been on the decline for some time. The secular rise in market power can also be linked to the declining labor shares, as well as the decrease in labor market dynamism (Loecker et al., 2020).

These considerations show that there is currently a need for stricter regulation to ensure competition in goods markets. Consequently, the European Commission has emphasized the pivotal role competition policy plays in supporting Europe's ambitious Green Agenda (European Commission, 2021). In addition, Germany's Green Party has made green regulation and competition policy a hallmark of their climate policy (Giegold, 2019), which has led some economic observers to call the emerging green policy agenda "Green Ordo-Liberalism" (Gabor, 2022). Interestingly, Green Ordo-Liberalism is in principle consistent with the complete privatization of green investment (Gabor, 2022) and has little to offer regarding a pro-worker green transformation.

4. MODERN CLIMATE POLICY

This section defines and analyzes the modern approach to climate policy. Subsection 4.1 discusses the shortcomings of the traditional approach. Subsection 4.2 defines modern climate policy and Subsection 4.3 provides a rationale for such a policy approach from a market-failure perspective. Subsection 4.4 discusses examples of policy decisions in Germany that resemble elements of modern climate policy. Finally, subsection 4.5 argues that the Inflation Reduction Act (IRA) is an (imperfect) attempt to implement modern climate policy in the US.

4.1. Shortcomings of the Market-Liberal Approach

As we have seen Section 3, the market-liberal approach dominates the public debate on climate policy. It is the theoretical framework most economists, including climate economists, use when providing policy advice. Unfortunately, this approach rests on a theory that neglects important dimensions

¹⁴ See Sandel (2020) for a discussion why this approach is likely to fail because it is grounded in a meritocratic ethic that creates resentment and is morally questionable.

of reality. This shortcoming often leads to questionable policy recommendations. Specifically, there are two structural features of real societies that are not captured by the market-liberal theory, but that ought to be taken into account by any comprehensive analysis of large-scale transformations such as the climate transformation.

The first missing element is complexity. Specifically, people and companies need time to adjust, and the switch to climate-neutral behavior often entails substantial investment and dislocation costs, including the human capital losses associated with job loss.¹⁵ Further, the transition to a new economy involves individual and macroeconomic risks that cannot be insured through market contracts. The combination of large individual adjustment frictions/costs and a high degree of uncertainty means that, in reality, the transition to a green economy may not go as smoothly as market-liberal economists may imagine. In other words, market liberalism creates the fictitious commodities “land” (nature) and “labor” (humans), assuming that they can adjust smoothly to changing economic conditions, and therefore counterfactually assumes the possibility of disembedding the economy from society (Polanyi, 1944).

The following example illustrates how adjustment costs (complexity) provides an obstacle to a smooth green transition. Climate-neutral steel production based on green hydrogen is possible (Krebs, 2021), but it requires companies to make large investments in new machinery, with at least a few years to build the new production plants, while the price and availability of green hydrogen in the next 15 years is highly uncertain. In addition, workers at the steel companies will require re-training, and some may have to look for a new job in case their old company has to downsize. In other words, companies and workers in the German steel sector have to adjust to new conditions in a highly uncertain world, the adjustment comes with large individual costs, and workers and companies cannot fully insure at fair insurance prices against all of the risks involved. Indeed, the most important risk in the green transition is the macroeconomic risk: will the world manage to develop a thriving hydrogen economy in the next 10 to 15 years that will supply sufficient amounts of green hydrogen to a transformed steel industry at competitive prices?

The second missing element in the market-liberal approach is the existence of (market) power that prevents competition for structural reasons, and therefore inevitably leads to a monopoly situation (natural monopoly). This situation often occurs in the area of transport infrastructure, where the government often only has the choice between a regulated, private monopoly and the monopoly of a company in state ownership.¹⁶ The issue of natural monopoly is relatively important since public

¹⁵ See, for example, Huckfeldt (2022) and Schmieder et al. (2022) for recent work and surveys of the literature on the long-term earnings losses associated with job displacement.

¹⁶ It is also the infrastructure sector where the privatization of public companies during the 1980s and 1990s has probably gone too far causing harm to the economy and society. The academic underpinnings of the political movement towards privatization of public infrastructure/utility companies was provided by the work of Chicago economist George Stigler

infrastructure investment is a key factor in any successful transition to a green economy. For example, the large-scale production of green hydrogen will only occur in Europe by the end of the 2020s if there is a corresponding build-up of a pipeline system connecting producers with consumers, and this will require massive public infrastructure investments (Krebs, 2021).

In an unregulated labor market, the structural power asymmetry between capital (firm owners) and labor (workers) often leads to the exploitation of workers in the sense that the market wage is close to the subsistence (reservation) wage of workers. According to the modern search-and-matching theory of the labor market, this is not an efficient outcome.¹⁷ Specifically, a successful match between a worker and a firm creates surplus value where the division depends on the bargaining power of the individual parties. If capital owners possess all the bargaining power, then the wage is equal to a minimum level and all the surplus goes to the capital side. If workers (unions) possess all the bargaining power, then the wage is equal to the marginal (revenue) product of labor and all the surplus goes to the workers. Neither arrangement is efficient. Indeed, production efficiency is only achieved if there is an appropriate balance between capital and labor, and the surplus value is distributed fairly. The market-liberal approach to climate policy downplays the importance of complexity and power. However, these are important features of reality that are of first-order importance for understanding the transition process to a green economy.¹⁸ In other words, market liberal economists use an idealized model of reality that only allows for one type of market failure – externalities – and conclude that the optimal government policy is simple and one-dimensional – a common carbon price. However, reality is best described as a world in which at least three types of market failures coexist: first, externalities; second, adjustment frictions combined with uncertainty; and third, structural power relationships (market power) that call for public ownership of crucial infrastructure and fair labor market institutions (see below).

The discrepancy between market-liberal theory and reality has three important implications. First, the one-dimensional policy approach of market-liberal economists is bound to fail. To clarify this statement, if governments use a simple-minded carbon-pricing approach, then society will not successfully manage a green and just transition. A successful transition to a green and just economy

on regulatory capture (Stigler, 1971), who won the Nobel Prize in Economics in 1982 for his work on regulatory capture. See, for example, Dal Bo (2006) for a review of the literature on regulatory capture.

¹⁷ See, for example, Cahuc and Zylberberg (2004) for very good textbook treatment of the search-and-matching that was developed by the economists Peter Diamond, Dale Mortensen, and Christopher Pissarides, who won the Nobel Prize in Economics in 2010 for their work on the search-and-matching theory of the labor market. Cahuc and Zylberberg (2004) also contains a discussion of the efficiency condition that is known in the literature as the Hosios condition.

¹⁸ Of course, this does not preclude that models based on the market-liberal paradigm can reproduce a number of empirical findings, as shown, for example, by the real business cycle research. The specific claim made in this paper is that the market-liberal paradigm misses dimensions of reality that are of first-order importance for an understanding of the transition process to a green economy.

requires a coordinated, multi-dimensional government policy (that is, a modern climate policy), described in more detail below.

Second, market-liberal economists lack an understanding of institutional details and the relevant time-scales, and they compensate for this deficit with a strong faith in the healing power of market forces. Consequently, they almost always prefer a “cold-turkey” approach with little government support (shock therapy) to a more gradual reform approach supported by multi-dimensional government policy. Of course, economic history is full of examples of failed shock therapy.¹⁹ However, this empirical failure of the market-liberal paradigm does not concern market-liberal economists to a great degree since they have a simple explanation, which brings us to the last implication of the discrepancy between market-liberal theory and reality.

Third, market-liberal economists explain any wrong predictions of their theory with government failure. If shock therapy in Russia or East Germany did not lead to the smooth transition as predicted by market-liberal economists, then it is the government’s fault, since it did not deregulate and privatize fast enough. If minimum-wages do not lead to unemployment, then it is mainly because the government did not enforce minimum-wage laws or because business cycle conditions were exceptionally good. According to market-liberal economists, the Arrow-Debreu model (with externalities) is correct by assumption, and any clash of their theory with reality must be due to a government that is inefficient by assumption. No amount of empirical evidence will convince the market-liberal economists that the biggest problem may be a simplistic theory that misses important dimensions of economic and social reality. Of course, this immunization strategy of market-liberal economists is as old as market liberalism itself (Polanyi, 1944).

4.2. What is Modern Climate Policy?

We have seen that the traditional approach to climate policy is based on an old paradigm that neglects important features of reality and often leads to sub-optimal policy conclusions. If governments follow this policy, the necessary transformation of the economy is unlikely to be successful. In contrast, there is a modern approach to climate policy, which follows a new paradigm much more in line with reality. It replaces the old, market-liberal theory of society with a more realistic theory that takes into account complexity and power. From an economic perspective, this new approach to climate policy is more akin to modern supply-side economics.²⁰

Modern climate policy is a set of government policies and institutions that support people and companies in the transformation process to a green and just economy that is strong enough to provide

¹⁹ See, for example, Weber (2021).

²⁰ Janet Yellen has used the term in a speech to describe the Biden plan (Yellen, 2021). Sandbu (2021) uses “progressive supply-side economics” to describe some of the elements of the policy plans of the new German government (traffic-light coalition), and Klein (2021) calls a similar policy agenda “supply-side progressivism”.

the foundations for a prosperous society.²¹ In other words, a modern climate policy aims to generate green and inclusive economic growth. It does not contradict the basic tenant that competitive goods markets and well-defined property rights are a prerequisite for long-run prosperity. Similarly, modern climate policy is in line with the traditional approach, in the sense that it agrees that the policy instruments outlined in Section 3 (carbon pricing and transfer payments) are, in principle, sound. However, it goes beyond the traditional approach because the traditional policy instruments are insufficient for supporting a successful transformation of the economy.

Modern climate policy rests on two pillars. The first is a permanent expansion of public investment in people, innovative companies, and green infrastructure. This part of modern climate policy is similar to the *Green New Deal* (*Green European Deal*) and it entails large elements of a *Green Industrial Policy*.²² However, it also includes a strong pro-worker element, which makes it a *Pro-Worker (Fair) Green New Deal*, respectively a *Pro-Worker (Fair) Green Industrial Policy*.²³ For example, it requires that subsidies for private investments are not only linked to green criteria, but also to the payment of fair wages to foster a good-jobs economy. The first pillar of modern climate policy enhances the opportunities for people and businesses to thrive and provides the foundation for a technology-driven and just transition to a green economy. In economic terms, it consists of a set of government policies that reduce adjustment costs and uncertainty in the transformation process.²⁴

Specifically, the first pillar consists of three main elements.²⁵ First, it includes subsidies for private investments in green technologies to provide the right incentives to transform the privately held physical capital stock of the economy. This policy instrument is the cornerstone of the Inflation Reduction Act of US President Joe Biden, which is discussed in more detail in Section 4.5. Second, the next element is that of subsidies and other public support for re-training workers to help them acquire new skills so that they can perform new jobs in a green economy.²⁶ This type of human

²¹ Notice that modern climate policy puts the emphasis on the rewarding people and companies for “good” behavior (“carrots”), whereas traditional climate policy focusses on the punishing people and companies for “bad” behavior (“stick”).

²² See Altenburg and Rodrik (2017) and Rodrik (2022) for an exposition of green industrial policy along these lines. The recent policy recommendations of the Club of Rome also include the main elements of a green industrial policy (Dixson-Decleve et al., 2022).

²³ Rodrik and Stantcheva (2021) propose a strategy that includes many elements of the modern approach to climate policy outlines here. Most importantly, the policy proposals of Rodrik and Stantcheva (2021) focus on the supply side (productive sphere) and have a clear pro-worker (good jobs) focus.

²⁴ A broad definition of this pillar also encompasses public investments that enhance the human and social capital of individuals before they enter the labor market such as high-quality public education for all children and public investment in housing to build diverse neighborhoods in all parts of the country. In addition, it also entails public investment that remove obstacle to female labor force participation (in full-day schools and child-care). These elements of a Green New Deal are important, but not further considered in this paper because of space limitations.

²⁵ These three components play an important role in a place-based approach to regional policy to manage structural transformation (Suedekum, 2022).

²⁶ For example, workers in the car industry need retraining when the production of cars with combustion engines decreases and the production of electric vehicles expands. Similarly, the transformation of the production process in the chemical and steel industry away from natural gas and coal towards a hydrogen-based production will create new jobs that require a new set of skills.

capital investments is essential for a successful transformation and has, in general, large payoffs in the long-run. Finally, it requires an expansion of public investment in green infrastructure that provides the foundation on which people can build their lives and companies can build a green business model.²⁷ This part amounts to the transformation of the public capital stock of the economy into green, public capital stock.

The second pillar of modern climate policy is a set of rules and regulations that ensure a level playing field in the market for land and labor; that is, the creation of pro-worker green institutions. In a certain sense, the second pillar of the modern climate policy is an application of the general ideas of *Social Liberalism* applied to the markets for land and labor in a modern society. This second pillar creates the conditions for a pro-worker green industrial policy to work and provides the foundation for a successful transition to a green, good-jobs economy. In other words, the pro-worker green industrial policy (pillar one) and the pro-worker green institutions (pillar two) are complementary government decisions that reinforce each other.

Specifically, the second pillar entails institutions that make a green economy possible and strengthen the voice of employees in production. In other words, this pillar is concerned with institutions in a modern society that ensure a level playing field in the markets for the fictitious commodities “land” (nature) and “labor” (humans). For example, the green transformation requires a massive expansion of green infrastructure investment, which will only fully succeed if completed by public companies that allow for a better alignment of public interests with actual investment decisions. Thus, a functioning system of public infrastructure companies is an underlying prerequisite for a green transformation. With respect to the fictitious commodity labor, rules and regulations that expand union coverage, workers’ councils and co-determination (social partnership) are examples of fair institutions.²⁸ In addition, the minimum wage is a classic instrument to support workers to receive a fair share of the value they create. Finally, worker-friendly public procurement that conditions public contracts on decent pay and the existence of workers’ councils is an additional means for the government to break the power asymmetry in the labor market.

The following table summarizes the main elements of modern climate policy (new paradigm) and contrasts them with the corresponding instruments of the traditional approach (old paradigm).

²⁷ For instance, green hydrogen will be a central part of any future renewable energy system, and a new pipeline system for the transportation of hydrogen within Europe will be needed. In addition, a green economy will require a massive increase in the production of electrical power, which in turn requires a massive expansion of the current power/electricity grid in Europe. Finally, a climate neutral transportation system for the goods and services is only possible if the current railway system is improved.

²⁸ See Jaeger et al. (2022) for a discussion of the German model of social partnership.

Old Paradigm	New Paradigm
Minimal Government Intervention	Pro-Worker Green Industrial Policy
Punish climate-unfriendly investment through carbon pricing	Support green private investment through targeted subsidies
Provide transfer payments for the “losers” of the transformation process	Support investment in workers through apprenticeship and training programs
Trust the market to increase green investment	Expand green public investment
Trust the market to increase wages	Make subsidies and public contracts conditional on good pay to boost wages
Deregulation and Privatization	Pro-Worker Green Institutions
Bust unions and prevent workers from organizing	Support labor organizations (unions, work councils) to give workers a voice
Trust the market to increase wages	Use minimum-wage laws to boost wages in sectors not covered by collective bargaining
Privatize education and worker training	Provide a system of public education and public apprenticeship/training programs
Privatize public companies	Provide the foundation for green public investment by creating public companies

4.3. Why Modern Climate Policy?

From an economic point of view, modern climate policy is a set of government policies that try to correct market failures that play no role in the market-liberal paradigm. In the case of the first pillar of modern supply-side economics, the main market failure is caused by large (non-convex) individual adjustment costs and uninsurable risk. Specifically, public investment in workers, companies, and green infrastructure reduces adjustment frictions and uncertainty, thereby alleviating a market failure. In the case of public infrastructure investment, public ownership also overcomes the inefficiency that occurs when there is a situation of natural monopoly.

More formally, consider the basic macroeconomic model of climate change discussed in Section 3.2, and let us extend the framework to allow for search frictions and unemployment in the labor market. In this case, the transition to a green economy would involve “adjustment costs” to be borne by workers who lose their old job in the old, fossil economy and must find a new job in the green

economy. In addition, these workers have to re-train and not all the risk they have to bear is insurable. In this extended model economy, new results would emerge. First, the socially optimal carbon price in the economy with adjustment frictions in the labor market (unemployment) is lower than in the economy without such adjustment frictions. This result shows that the carbon price derived from Nordhaus-type models is in a certain sense “too high” and explains the popular resistance to high carbon prices. Second, there is an economic rationale for public re-training programs, or at least public subsidies for retraining workers, to support these workers in the transformation process. Finally, if companies in the sectors that heavily rely on fossil energy cannot easily switch to new, green technologies, then it becomes socially optimal to use target investment subsidies as a policy instrument. The second pillar of modern supply-side economics (fair labor market institutions) aims at correcting market failures due to market power in the labor market. Specifically, there is a structural power asymmetry in the labor market so that without government intervention the capital side often has most of the bargaining power. Thus, the surplus value of existing employer-employee matches is distributed inefficiently between firms (capital) and workers (labor) since the capital side receives most of the surplus value. According to this viewpoint, unions, co-determination, workers’ councils, and minimum-wage laws are instruments to remove this power asymmetry and move it a balanced labor market. In addition, these labor market institutions support a good-jobs economy by giving firms an incentive to invest and create more good jobs with high productivity at the expense of bad jobs with low productivity (Acemoglu, 2001, 2019).

More formally, in the standard search-and-matching model of the labor market, the existing worker-firm production match creates a surplus value that has to be divided between workers and firms.²⁹ If firms (employers) have all the bargaining power, then all the surplus goes to firms, as profits and workers are paid for their reservation wage, which can be quite low for workers who have little outside option (subsistence wage). If workers have all the bargaining power, then all the surplus goes to the workers and they are paid their marginal product. In a certain sense, the first case is the Neo-Marxist assumption (Marglin, 1984) and the second case the neoclassical assumption. Neither case is efficient since aggregate production is maximized somewhere in-between. In most capitalist economies, there is a power asymmetry between capitalists and workers, and many workers can only earn more than the subsistence wage by organizing themselves through unions or other means. Of course, the structural power asymmetry in the labor market is the historical reason why unions were created in the first place.

²⁹ Krebs and Drechsel-Grau (2021) provide a more detailed discussion of the relationship between the search-and-matching model of the labor market used in the mainstream economics literature and neo-Marxist approach to distribution and production.

There is alternative perspective on modern supply-side economics that goes beyond the market-failure argument and is inspired by Mariana Mazzucato's work on the entrepreneurial state (2015) and mission economics (2020). This approach acknowledges that governments play an important, active role in the transformation of an entire economy and emphasizes the coordination problems that an active state must solve. In such a situation, clearly defining and communicating an overriding mission and implementing a corresponding government plan/strategy is an essential coordinating device for all actors involved in the transformation process. At a very basic level, there are two types of coordination problems.³⁰

The first is a coordination problem within the government. Modern climate policy entails a set of major policy shifts that concern several federal ministries and affect various parts of the economy. For example, a successful implementation of the Green Industrial Policy requires the coordination of various plans and this type of policy coordination is reasonably difficult to achieve in a country like Germany that has a multi-party government and a tradition of consensus-driven policy making. In contrast, the US presidential system makes this type of coordination within the government administration (executive branch) much simpler, however getting parliamentary approval of any proposed policy plans (legislative branch) is often extremely challenging in the US. Finally, in both countries the decentralized nature of government that delegates control to state and local governments has often proven to be a major obstacle to the swift implementation of important, national policy changes.

The second coordination problem arises between the private sector and the government sector. The transformation of large parts of the economy to reach climate neutrality forces companies to invent and develop new business models and technologies in a highly uncertain economic environment. In addition, the profitability of various business models and technologies depends on the future availability of green energy, which, in turn, strongly depends on today's governmental decisions. In such a situation of great uncertainty and change, many companies will move not ahead with their business plans without a clear signal from the government that often includes the communication of an overall strategy, as well as the rapid implementation of individual policies.

4.4 Modern Climate Policy in Germany

After 16 years in power, German chancellor Angela Merkel decided to step down in 2021 and her right-center party, the Christian Democratic Party (CDU), lost the election. On December 8th, 2021, the new chancellor Olaf Scholz and his cabinet ministers were sworn in. The new German government consists of a three-party coalition that is often called the "traffic-light coalition": the Social

³⁰ The formal economic modelling of such possible coordination failures would be a game-theoretic approach.

Democratic Party with Chancellor Olaf Scholz (red), the Green Party with Vice Chancellor and Minister for Economic Affairs and Climate Action Robert Habeck (green), and Finance Minister and leader of the Liberal Party (Free Democratic Party), Christian Lindner (yellow).

The new German government adopted a policy approach that includes elements in line with modern climate policy (outlined in this paper). This policy shift is reflected in the fiscal budget of 2022 and the fiscal plans for 2023–2026 (BMF, 2022). Specifically, a new Climate-and-Transformation Fund has been created and for the five-year period 2023-2026, public funding of 180 billion Euro for green investment has been made available, at 45 billion Euro or more than one percent of GDP per year. In addition, on October 1, 2022, under the umbrella of “Alliance for Transformation”, representatives of the government, business and labor meet to discuss industrial policy and the federal minimum wage was raised to 12 Euros. Finally, the Federal Ministry for Economic Affairs has become the Ministry for Economic Affairs and Climate Policy and it was reorganized to facilitate the incorporation of the climate policy agenda of the new government.

Two policy decisions of the new German government most clearly demonstrate the shift towards a modern climate policy. First, there is the issue of financing. As discussed in Section 4.2, the new policy paradigm requires a major expansion of green public investment (the Green New Deal). In addition, there are sound economic arguments for a debt-financing of such investments, in particular in countries like Germany with already high tax and social security rates. However, Germany has a balanced-budget rule (debt brake) for the federal government that is enshrined in its constitution, and this has started a broader debate as to the extent to which this stringent fiscal rule is preventing public investment. As a result, the German debt rule allows for unlimited deficit spending in the case of an economic crisis, and this exemption was used in the fiscal years 2020–2022, not only to finance crisis measures, but also to replenish the Climate-and-Transformation Fund, thereby providing funds for private-investment subsidies over the next few years. Additionally, an often overlooked important “detail” of the German debt rule is that most public investment spending is exempt from the balanced-budget requirement so that public investment can be debt-financed. In other words, the German debt brake allows for the implementation of the Golden Rule of Public Finance.³¹

A second major policy shift is the clear commitment of chancellor Olaf Scholz to a pro-worker policy. This commitment becomes clear when looking at the minimum wage in Germany. In the election campaign in 2021, Olaf Scholz and his Social Democratic Party ran on a platform that made raising the minimum wage from 10.35 Euro to 12 Euro a key policy issue (about 16 US dollar in PPP

³¹ See the paper by Krebs, Steitz, and Graichen (2021) for further details. The suggestions made in this paper found their way into the coalition treaty in late 2021, allowing the new federal government to finance a significant part of the increase in future public investment via debt.

exchange rates). Once elected, there was no discussion within the three-party coalition that the minimum wage would have to be raised to 12 Euro (and this took place in October 2022), even though the co-governing Liberal Party is, in principle, against it: it was simply not an issue that was up for discussion in the newly formed government coalition. These developments stand in stark contrast to the debate before the introduction of the minimum wage of 8,50 Euro in 2015, where chancellor Angela Merkel was first against it and her own (pro-employer) party CDU fiercely resisted any type of minimum wage, until Angela Merkel changed her position due to pressure from public opinion and the co-governing SPD.

Modern climate policy is not only a collection of individual policy instruments, but also a commitment to an active state that has a clear strategy, and which is willing to make the first move in an uncertain world. Clearly, this aspect of modern climate policy is still “under development” in Germany, which comes as no surprise since German public opinion has always been rather skeptical of industrial policy and media coverage has usually been quite negative. For example, the Kiel Institute (IfW) annually publishes a report on the volume and types of subsidies in Germany (Laaser et al., 2021), and the publication is often accompanied by a “heavy dose of lamenting” from economists against any type of subsidies. Since Robert Habeck of the Green Party took over at the newly created Ministry for Economic Affairs and Climate Policy, the ministry staff have started to work more systematically on policy proposals that could presumably be part of an overall industrial strategy.³² However, it appears too early to say if these attempts will add up to a coherent set of policies, but one test of German policy makers will be their response to the Inflation Reduction Act put forward by US President Joe Biden.

4.5 Inflation Reduction Act

As outlined in the previous section, the new German government has already taken first steps towards a modern climate policy in the last couple of years. However, two recent events have made it necessary to take further, bolder steps. First, the energy crisis and the associated increase in the price of fossil energy will accelerate the transformation process, which requires the government’s efforts to increase accordingly. Second, the US has moved ahead with the implementation of the Inflation Reduction Act (IRA), and there is a danger that a part of Germany’s industrial base will move to the US if there is no adequate German (respectively European) policy response to the US policy. In this section, we discuss the main elements of the IRA with respect to climate policy and the necessary

³² The first public step towards industrial policy in Germany was taken by Peter Altmaier (CDU) in 2019, when the then-Minister for Economic Affairs of the old Merkel government put forward a very preliminary proposal. Most economists and the economics media reacted negatively to these ideas (Feld et al., 2019, Schumann, 2019). Of course, Peter Altmaier presented his initiative only based on a few loose ideas and relatively general guidelines, which might have added fuel to the fire.

policy reactions of Germany, respectively the European Union, to this bold policy move by the US Administration.

At its core, the IRA contains important elements of a pro-worker Green Industrial Policy and therefore constitutes a perfect example of modern climate policy. The IRA was signed into law by US President Joe Biden on August 16th, 2022. Together with the Bipartisan Infrastructure Bill (BIL) and the Chips and Science Act, it is the third piece of legislation that aims at improving the competitiveness and innovative power of the US economy with a special focus on manufacturing jobs. The three bills taken together will provide additional federal funding of \$2 trillion over the next 10 years for various programs. The IRA directs nearly \$400 billion of federal funds towards clean energy and green investment to lower carbon emissions, which will be distributed as a mix of tax cuts, grants, and loan guarantees (White House, 2022a).

Specifically, \$216 billion of tax incentives and \$80 billion of grants will be used to subsidize private investment in clean energy, transport, and manufacturing. In addition, the US Department of Energy will receive \$12 billion to expand existing loan programs and create a new loan program to provide up to \$250 billion of loans for improving the energy infrastructure. Finally, consumers will receive tax credits of \$ 43 billion for buying electric vehicles, energy-efficient appliances, and rooftop solar panels.

The IRA is not only a green industrial policy, but also emphasizes the pro-worker aspect of the policy. Specifically, the IRA's subsidies come with conditions to expand domestic employment and to boost wages (White House, 2022b). It aims at revitalizing US manufacturing by providing tax incentives for US-sourced products, such as batteries, solar, and offshore wind components. Further, clean-energy tax credits are increased if the amount of American steel used in wind projects meets the domestic content threshold. The tax credits are increased by an additional 10% if the clean energy projects are established in communities that have previously relied upon the extraction, processing, transport, or storage of fossil energies coal, oil, or natural gas. Finally, bonus credits apply to employers who use prevailing wages and apprenticeship programs, ensuring that federal tax policy supports well paid, highly-skilled jobs.

The reaction of European policy makers to the IRA has been mixed. On the one hand, there is strong support for a US Administration that has finally created a promising climate package. On the other hand, the conditions of the IRA favoring domestic production are seen by some as protectionism that go against the idea of free trade and WTO regulation. Clearly, this criticism of the IRA is valid if one assumes incorrectly that there is no need for industrial policy in the first place. In contrast, the modern approach is built around a forward-looking government that implements a pro-worker green industrial policy, which in reality often requires conditioning the government subsidies

on domestic production, employment, and wages. Nevertheless, pro-worker green conditions are already difficult to enforce domestically, but nearly impossible to enforce globally.

There is currently no agreement among EU countries how to react to the US challenge. While France is clearly in favor of adopting a US-type climate policy in Europe, and French President Emmanuel Macron has floated the “Buy European” idea, in Germany the situation is more complex. As a member of the Social Democratic Party, Olaf Scholz is intuitively aligned with the pro-worker approach of the IRA to climate policy, however he needs to concentrate on finding common ground within his three-party coalition and the EU more broadly. The Green party’s Economics Minister and Vice Chancellor Robert Habeck has asked for a “robust response” to the IRA, however his ministry has not articulated what this could mean in policy terms. Finally, the Finance Minister Christian Lindner from the Liberal Party is naturally inclined to view industrial policy as a harmful government intervention and is concerned about the fiscal costs of additional programs, however, he also sees the US as a natural ally and is therefore inclined to have a favorable view of US policy.

The analysis in this paper clearly shows that Germany should not fight the IRA, but instead embrace it and support a European version of the Green and Fair New Deal. In other words, the IRA is, in principle, the most sensible approach to climate policy, and there is little to be gained from criticizing sensible policy.³³ Further, the EU has the opportunity to improve upon the US climate policy because its institutional set-up is more conducive to implementing a Green and Fair New Deal. More precisely, there are three areas where the EU’s version of the IRA could be greener and fairer than the US original.³⁴

First, whereas the IRA almost only contains subsidies for private, green investment, the EU should also expand public investment in green infrastructure. The advantage of public infrastructure investment over private infrastructure investment is that the former allows for a better alignment of public interest with investment decisions, which implies that actual infrastructure investment is, on average, greener and more worker friendly. In other words, regulatory capture is less of an issue with public companies than with private companies. Of course, this type of policy requires the existence of a sufficient number of public companies who have the common good as part of their mission. This requirement puts the US at a disadvantage since a large part of the utility sector in the US is in the hands of private investors whose key goals are to maximize government-subsidized private returns. Of course, some EU countries like Germany are currently in not much of a better position than the

³³ Note that in this paper the economic argument in favor of the IRA is based on the idea of (non-convex) adjustment cost and uncertainty that the IRA-policy addresses directly. The literature on strategic trade policy (Brandner, 1995) could provide an alternative rationale, though the economic mechanisms differs and the policy argument in favor of the IRA would be weaker. Specifically, strategic trade policy assumes that the fundamental market failure is due to a strategic relationship among firms (oligopoly), which means that trade policy is only a second-best policy and the first-best policy would be to address the issue of oligopoly in goods markets directly (see the subsection on market regulation).

³⁴ The discussion is by no means comprehensive. For example, it is important to design “competition-friendly” industrial policy that foster innovation and productivity growth (Aghion et al., 2015).

US, since a wave of privatizations in the 1990s has left the energy infrastructure in the hands of private companies or foreign state companies.³⁵

Second, the European labor market institutions are much better suited than the US institutions to enact a pro-worker industrial policy. Specifically, union coverage is much higher and even in countries like Germany, where union coverage is below 50 percent, in almost every sector some wages are covered by collective bargaining agreements that can be applied as a useful benchmark. In other words, the condition that companies receiving subsidies should pay fair wages can be easily implemented through the requirement that these companies have to pay union wages. Indeed, in Germany there is currently legislation under way that will require public-procurement contracts of the federal government to include a union-wage condition, and similar legislation could be designed to supplement any new investment program.

In addition, the IRA also includes bonus credits for employers who use apprenticeship programs to support the creation of highly-skilled jobs, however the success of these worker training programs very much depend on the availability of high-quality teaching programs that work together with companies. Such programs do not exist in large parts of the US. In contrast, Germany and some other EU-countries have a long tradition of using apprenticeship and re-training programs to support workers in acquiring the technical skills needed for most industrial jobs.

Finally, one shortcoming of the industrial policy is that it will do little to boost wages in the low-wage segment of the service sector. This is the reason why minimum-wage laws are essential for any pro-worker policy agenda, and EU countries should use the opportunity to reach the common goal of achieving an adequate minimum wage that is fair and provides a decent standard of living (European Commission, 2022). For example, the German government has recently raised the minimum wage from 10.35 Euro to 12 Euro (about 16 US dollar in PPP exchange rates), which is an important and significant step towards a fair minimum wage. However, a large part of this minimum-wage hike will be “eaten up” by high inflation in 2022 and 2023. To be in line with the EU declaration on minimum wages, the German minimum wage needs to be raised to at least 14 Euro (about 19 US dollar) as soon as possible.

³⁵ For example, in Germany large parts of the electrical grid are owned and operated by the Dutch state company tennet, and large parts of the pipeline system for the transportation of natural gas was owned and operated until a few months ago by the Finnish state company Uniper and the Russian state company Gazprom Germania.

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