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Overlooked factors for a successful energy transition

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- **Carbon pricing is a key driver of the transition process as it provides incentives to innovate, finance, and invest in clean technologies**
- **From the perspective of the transition, carbon pricing is not enough alone to complete the mission due to transition failures**
- **A transition failure arises when the market outcome does not correspond to the transition optimal outcome, or when there is delay in responsiveness to a rise of market failures along the transition**
- **To overcome transition failures, there is a need to develop comprehensive energy transition strategies that address the complexity of the transition process**
- **In that regard, coordination between stakeholders and across sectors is key for a timely and successful energy transition**
- **Avoiding locking-in high carbon technologies, a cooperative behavior of fossil fuel suppliers, and a sufficient level of efficiency improvements are important factors to reach transition goals**
- **All in all, a successful transition needs a much higher degree of state intervention with a dynamic recalibration of policy levels following the any rise of transition failures or bottlenecks**

Introduction

The energy transition represents a structural shift in our economic system where consumption and production paradigms are expected to change. Energy will shift away from fossil fuels towards more renewable energy sources, while efficiency improvements, electrification, hydrogen, and synthetic fuels are the main pillars for the transition. Transition is driven mainly through policy intervention, technological progress, and the change in consumer behavior. However, application is usually met with some unforeseen complexities.

In this article we aim to highlight the specificities of the current transition by articulating some of the overlooked challenges that hinder or slow down the timely achievement of transition goals. Furthermore, we highlight the essential components needed to be considered for a successful transition. We judge that such issues need to be brought to the forefront to better understand the transition dynamics and be prepared to address them in a timely and efficient manner. Accordingly, the article touches on a wide range of transition related areas with a mutual theme of overlooked challenges. We emphasize here that these challenges are of generic nature and may apply to certain countries or regions or not. The added value here is to collect these challenges in one place.

Carbon pricing at the center of transition

Carbon pricing is a key driver of the transition process. Carbon pricing provides incentives to innovate, finance, and invest in clean technologies. Each climate goal is driven by a profile of carbon price over time, where higher carbon prices are needed to achieve more ambitious goals. However, transition scenarios do not take into account the political plausibility of implementing such high carbon prices. For example, the energy crisis in Europe, triggered by the Russian invasion to Ukraine, showed that there are limits to the speed of the rise in energy costs that governments would tolerate. Indeed, governments intervened to support different parts of the economy whether through fuel tax reductions or subsidies. This highlights the sensitivity to high transition costs associated to an abrupt transition scenario reflecting a late/postponed climate action. Accordingly, there is a role for the government to monitor and calibrate the level of carbon pricing along the transition process in order to avoid additional unnecessary costs.

Furthermore, from the perspective of the transition, even though carbon pricing plays an essential role to align incentives towards transitioning the economy, it is not enough alone to complete the mission. Regardless how high the level is, it does not guarantee the achievement of needed outcome in a timely manner because of market limits and the emergence of “transition failures”, which we turn to next.

Market limits and transition failures

As mentioned above, most economists have a core belief that carbon pricing is one of the main drivers/instruments for the transition. The intuition is that carbon pricing will create a competitive advantage for low carbon alternatives, and thus, the needed incentives to invest in these technologies. Such a process is facilitated through the market mechanism where resources will be reallocated to its most efficient alternative. However, under certain circumstances markets can fail to deliver the optimal outcome from a societal perspective, and carbon prices may not on its own able to fully correct the failure.

Market failures arise usually in the presence of underpriced externalities (for example, carbon emissions), asymmetric information, monopolies, and related to the nature of the goods (for example, public goods). Where in such situations the intervention by the government is needed to correct for such externalities and achieve the social optimum outcome.

By definition, any transition is a dynamic process that involves the interaction between many variables. During such a process, priorities are set in a way that does not necessarily match the market outcome in allocating resources. That is, the market outcome may not be the right outcome from the transition perspective. For example, a transition priority could be to enhance the development of certain technologies (renewable power for example), or the allocation of scarce resources towards certain economic activities that have a role to play in the transition to boost their deployments (allocating renewable power to produce green hydrogen, for example). Furthermore, the unprecedented transition process could trigger the emergence of market failures. The absence of a timely intervention to solve such failures would create bottlenecks that slow down the transition process and increase its associated costs. For example, the limited capacity of the grid could create a delay investment in renewables and electrification which would create additional transition costs. We call these two kinds of situations “transition failures”.

For our purpose, we define transition failures as any development that could hinder or slow down the transition process. That is, a transition failure arises when the market outcome does not correspond to the transition optimal outcome, or when there is delay in responsiveness to a rise of market failures along the transition process. Accordingly, transition failures could be expanded to any situation that hinders or slows down the transition process. For example, as mentioned in subsequent sections, locking in certain high carbon technologies even in the presence of carbon pricing can be considered as a form of transition failure. Another example would be the lack of coordination between different stakeholders and the absence of a clear vision for the transition process, which induce a waste of valuable resources that could be used to move the transition further. Another transition failure, which induce a delay in the transition process is the slow responsiveness of supply following a sudden surge in demand after a certain transition shock. For example, after the energy shock in Europe, following the start of the Ukrainian war, even with high readiness to pay, waiting times to have a heat pump installed extended to long periods of time as supply had limited capacity to meet the surge in demand for heat pumps and adjustment in supply needed long periods of time. This could translate into value loss for assets, such as selling a house at a lower price just because the energy label cannot be increased in time.

To overcome transition failures, there is a need to develop comprehensive energy transition strategies that address the complexity of the transition process. This requires collaboration among multiple stakeholders, including governments, the private sector, and civil society, which we turn to next.

Different types of coordination

Coordination between different stakeholders is one of the challenges that need to be taken into account within the energy transition. Coordination between economic actors does not evolve naturally through market dynamics even with the presence of carbon pricing or R&D subsidies because of the collective action nature of the problem. For example, in the Netherlands, the implementation of CCS is a promising option to achieve climate targets (promising 7 mega tons of CO_2 reductions), but the implementation of these CCS projects has not been a success with three failed projects (two onshore in Barendrecht and the Northern regions, and one offshore near the Port of Rotterdam). The failure of these projects is attributed to technical, economic, legal and societal challenges.

Intertemporal (time dependent) coordination is also essential for a successful transition path. There are two issues in this regard. First, is to take into account any possible feedback loops that might emerge between sectors through the prices of mutual inputs. For example, electrification is envisioned to be the main channel to green several sectors, with the transportation sector a key example. If such switch took place at a relatively faster speed in the transportation sector, relative to other sectors, it will increase the demand of electricity and reduce that of oil, which in turn makes oil cheaper and more attractive to be used by other sectors, which in turn could hinder the transition in such sectors. To avoid such feedback loops, governments should intervene in time by increasing carbon prices, or taxes on oil, or use price floors for oil in order to keep the incentives to transition active across sectors.

The second issue with intertemporal coordination regards the transition speed of the different components of a certain market. For instance, the supply, demand and infrastructural capacity in the power markets, where there is a need for coordinating the growth in these three elements along the transition process. With electrification considered to be the main transition path for many sectors, growth in power demand is inevitable. Thus, a timely deployment of the needed renewable capacity that meets the growing demand and replacing fossil fuel-based power generation is essential to meet the transition goals in this sector. But at the same time, the growth of infrastructural (grid) capacity is crucial to keep the transition going in this market. The problem here is not the absence of policies, such as carbon pricing, but the timely response from the markets. The delay in the extension of grid capacity could be related to market-specific uncertainties, complex permitting procedures, and others. Such coordination problems need to be foreseen, solved, and addressed in advance to avoid unnecessary delays or additional cost.

Therefore, to achieve a successful transition, carbon pricing should be complemented with other interventions that tackle dynamic barriers related to coordination between different actors and sectors over time, which could be done through collaborative arrangements between relevant stakeholders.

Lock-in and vested interests

Technology lock-in refers to the situation in which the adoption of alternative technologies is not taking place even with the presence of high economic benefits to the adoption of these new technologies due to existence of obstacles such as vested interests and network effects. From an energy transition perspective, locking-in high carbon technologies would affect the ongoing transition and alter the materialized transition path even with the existence of appropriate policies. Possible reasons for locking-in certain high carbon technologies is the increasing returns of adoption which leads to path dependency. This is because once interests are established in a sector or technology, while having at the same time the support from the system, the cost of changing/reversing the path become quite high and lock-in is most likely to materialize even with the existence of superior low carbon alternatives.

Technology lock-in advocates argue that the state should step in to coordinate technology adoption decisions, which could be done through more sector specific/tailored policies.

The impact of fossil fuel supply on the transition process

With regards to fossil fuels markets and prices, we tend to focus on the demand side in our transition narratives, while implicitly assuming a passive response by fossil fuel suppliers. In reality this is not the case. Suppliers of fossil fuels could act in ways that affect the transition whether in the short or long run. The famous example for this is the "green paradox" idea, which states that in response to an expected tightening in climate policies, suppliers could opt for extracting more from their reserves in the short run which will increase emissions. Such behavior by fossil fuel suppliers has also a negative effect on the transition as lower fossil fuel prices would make the use of fossil fuel more attractive than their clean alternatives, which would slow down the transition process. Alternatively, if fossil fuel supply decreases sharply before the development of clean alternatives, we could enter in an energy crisis in the short run, just like the one we had after the start of the Ukrainian war. These situations enlighten the sensitivity of the transition process to the supply of fossil fuels, where government response is essential in such situations. Governments could increase carbon taxes or use price floor when supply is high, and conversely subsize fuels when supply is low in order to maintain appropriate transition incentives in place.

International aspects of the transition

The relation between trade and the transition is a two-way street, where the global transition in energy sources, as well as that of materials and products, is expected to influence the competitive position of different industries across countries. The envisioned transition in many countries towards renewable resources is expected to induce a change in the industrial mix across the globe. This in turn, will trigger changes in the future global value chains and trade flows. A relevant question here is: how global trade flows would look like with the global change in energy sources, as well as that of materials and products? Sketching scenarios on evolving industrial mix and associated trade flows towards 2050, will help analyzing any changes in international competitiveness and the position of certain industry in the future global industry map.

Furthermore, there are underestimation of the interregional transition risks. That is, the transition in one country could trigger risks in other countries through financial exposure or trade channels. The problem is that some of the current transition risks stress-testing exercises have a national or regional focus, which underestimate the potential risks that could originate from the transition in other countries or regions. For example, national/regional transition plans could involve a switch away from certain imported products that are used for consumption or production purposes. Such a shift would affect trading partners adversely and could trigger a revaluation of assets that could be of a massive size depending on the size of trade volumes between trading partners. Accordingly, international coordination between countries in their transition plans would be a key factor to reduce transition costs and minimize spillover effects across trading partners.

The role of efficiency improvements and resource savings

Efficiency improvements is the main transition channel for hard to abate sectors, where electrification is not possible. Innovation and technical change are the drivers for efficiency improvements. However, the process is quite uncertain, and improvements can be incrementally small to trigger any investments. Furthermore, uncertainty about future investments or breakthrough technologies may hinder, slow down, or defer investments especially for large long-term investments such as those in heavy industries. These industries are exposed to international competition with tight profit margins, which make them very sensitive to any rise in costs that would affect their competitiveness adversely. Accordingly, unless efficiency improvements are big enough to justify the cost of abatement, transition in these sectors will take more time than needed. Here the government could play a role in financing R&D programmes, incentivizing the adoption of low carbon technologies by improving their business case through subsidies or tax exemptions.

To summarize

This article highlighted specific aspects related to the ongoing energy transition. It focuses on overlooked challenges that hinder or slowdown the timely achievement of transition goals. Furthermore, we highlight the essential components needed to be considered for a successful transition. More specifically, we argue that from the perspective of the transition, even though carbon pricing plays an essential role to align incentives towards transitioning the economy, it is not enough alone to complete the mission because of invested interests or lack of coordination. Moreover, the concept of “transition failure” was introduced which arises when the market outcome does not correspond to the transition optimal outcome, or when there is delay in responsiveness to a rise of market failures along the transition process. Moreover, the article highlighted the importance of intertemporal coordination within and across sectors in order to avoid unnecessary delays or associated costs, along with the needed management of possible interregional risks that may arise when transition speed differ across trading partners. The behavior of fossil fuel suppliers along the transition process is also determinant on reaching timely transition goals. Finally, we argue that sectors that rely on efficiency improvements for their transition require more time to reach their targets because efficiency improvements need to be big enough to justify the cost of abatement. In summary, the one thing in common in all these challenges is that a successful transition needs a much higher degree of state planning/intervention with a dynamic recalibration of policy levels following the rise of transition failures or bottlenecks along the transition process.

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