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ABSTRACT

Geopolitical instability and climate change are about to bring about large-scale energy reconfigurations. Recent discoveries of fossil fuel potential echo important historical episodes, starting with the finding of natural gas reserves in the Netherlands in 1959, which gave birth to the notion of Dutch Disease, in reference to the macroeconomic structural readjustments that followed the resource boom. Recently, the economic literature on whether such a boom might be a blessing or a curse for a country has been growing. What has not received attention so far is the attitude of Dutch economists in the 1960s and 1970s and the lessons to be drawn from them in today's economic research. This article explores how they understood the gas boom, how they anticipated its effects, and the role they played in shaping Dutch energy policies. We show that the 1960s were a parenthesis, and that energy optimism has historically been more an exception than a rule. In situ economists correctly anticipated some but not all of the transmission channels of the resource boom. These results are insightful for the 21st century, as they not only allow for historicizing the concept of the resource curse but also provide lessons for macroeconomic policies in the context of the energy transition, especially in countries endowed with fossil fuels and mineral resources.

1. Introduction

In a context of geopolitical troubles and threatening climate change, which requires a sharp decline in the combustion of fossil fuels, in many parts of the world the time has come for energy reconfigurations. Renewables (e.g. solar power in North Africa, offshore wind farms for countries with large coastlines) promise unprecedented development prospects, and countries with recently found fossil fuel reserves (e.g. Senegal, Mozambique, Brazil) find themselves caught between financial opportunities and environmental imperatives (IPCC, 2022). The question of energy booms and busts, from their benefits to the risks they entail, is more pressing than ever.

On 26 November 1977, when *The Economist* coined the expression 'Dutch Disease' to characterize the industrial fragility of the Dutch economy after the oil shock, economists still had an imperfect view of the role of natural resources, especially energy, in economic development. The ancestral wisdom, since the Physiocrats in the 18th century and the Classics in the early 19th century, had been that abundant resource endowments were key for economic expansion. The success of Britain during the Industrial Revolution had been credited to its coal reserves (Jevons, 1865). And the bounty of nature had been perceived as one of the main causes of American prosperity in the early 20th century (Nourse et al., 1934). Development economists from the post-Second World War era confirmed the positive effect of natural resources on the process of increasing wealth (Rostow, 1960). On closer inspection, however, this vision was not fully consensual. Already in the 19th century, when examining the effect of gold mines on Australian prosperity, John E. Cairnes (1873 [1859]) highlighted the disturbing effects of a natural resource boom on domestic prices (Bordo, 1975; Boianovsky, 2012). A century later, Raúl Prebisch (1950) examined the case of the Argentinian balance of payments and argued that natural resources were a bad bet, as the price of raw materials structurally decreased overtime – an observation soon tempered by the growing quantitative literature on long-run prices (Hunt, 1989; Davis, 1995; Calcagno, 2021).

In 1959, when the Dutch found major gas fields in the province of Groningen, initially estimated at around 50 billion m^3, quickly revalued to more than 2200 billion m^3, it was considered a blessing (Lubbers and Lemckert, 1980). The Dutch economy had just recovered from the war and the energy supply consisted of a mixture of domestic coal and imports. In less than 10 years, the natural gas from Groningen came to

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cover 50% of the Dutch energy market and profoundly reconfigured the Dutch economy (Kaijser, 1996). Traditional manufacturing sectors were increasingly replaced by energy-intensive industries, such as the petrochemical sector or greenhouse agriculture. Household heating and cooking systems quickly turned to gas (Schot et al., 2000). And by the late 1970s, the Dutch government had developed a generous welfare state partly funded by gas revenues (Van Zanden, 1997).

When the oil shock occurred in the mid-1970s, fossil fuel prices skyrocketed, penalizing energy-intensive industries and weakening the overall new structure of the Dutch economy. Unemployment, which had started to increase a few years before, accelerated (from 2% in 1971 to almost 12% in 1983), and the government experienced growing difficulties with stabilizing the currency (guilder) (Van Zanden, 1997, 81). Hence the term 'Dutch Disease,' launched by *The Economist*, which would soon be substantiated by economic research trying to understand the relevant mechanisms explaining why and how a natural resource boom can result in de-industrialization (Corden and Neary, 1982; Neary, 1982; Corden, 1984). This literature, at first theoretical and then empirical, has continued to develop ever since.

Economists have abundantly investigated the resource curse and the Dutch Disease. But we know very little about how Dutch economists dealt with and reacted to the impactful discovery of the Groningen gas when they faced it in the 1960s, i.e. before the disease became fully manifest. Recent historical research on Dutch economic thinking in the post-war period focuses on neoliberalism and pays little attention to energy issues (Harmsma, 2019; Kösters et al., 2021; Mellink, 2020, 2021; Oudenampsen and Mellink, 2019a, 2019b, 2021; Mellink and Oudenampsen, 2022). Conversely, the scholarship on the Dutch gas discovery has only partially engaged with the economic consequences of these discoveries, and almost not with economists' perception of them (Lubbers and Lemckert, 1980; Ellman, 1981; Kaijser, 1996; Gales, 2013; Hölsgens, 2019). Yet the Dutch experience is likely to be rich in lessons, not only to historicize the concept of the resource curse, which has been called for by prominent researchers in the field (e.g. Van der Ploeg, 2011), but also for today's energy trajectories and policies. Economists' representations play a role in the design of energy futures – see for instance the importance of economic modules in integrated assessment models (Lefèvre, 2016; Cointe et al., 2019) – and in the orientation of the public agenda (Fourcade, 2009; Pestre, 2020; Maesse et al., 2022). At a time when, all over the world, energy policy choices are crucial for the next 25 to 50 years, learning from the way economists have anticipated and reacted to energy upheavals in the past can be extremely valuable. In this respect, the Dutch case has been seminal and deserves particular attention, especially in relation to today's discussions on stranded assets in the fossil fuel sector and on the boom of critical materials (lithium, rare earth metals, etc.) because of the expansion of renewables, electric mobility and digital devices.

This article examines the work of major Dutch economists such as Jan Tinbergen, Johan Gerbrand Koopmans, Pieter de Wolff, and lesser-known ones, many of whom worked for leading economic institutions like the Central Planning Agency (CPB) and the Statistics Agency (CBS), from the 1950s to the mid-1970s.[1] What were their expectations regarding energy and growth in the 1950s? How did they react to the discovery and what sort of macroeconomic effects did they anticipate? How did their analysis of the boom evolve throughout the 1960s and 1970s? What role, if any, did they play in the gas and macroeconomic policies of the Dutch government? What lessons can be drawn from this episode? To answer these questions, this investigation is based on a detailed analysis of original materials published (most often in Dutch) in economics journals such as *De Economist* and *Economisch-Statistische Berichten*, and reports by economic institutions like the CPB. It is also based on an unprecedented inquiry into archival documents from the CPB and the Dutch Ministry of Economic Affairs.[2]

The article is organized as follows. Section 2 offers more details on the Dutch Disease as it is established in today's literature. Section 3 depicts the economic and theoretical context of the 1950s in the Netherlands, by emphasizing the successful post-war policy of coal-based industrialization, which revolved around keeping wages lower than elsewhere for competitiveness. Section 4 analyzes the initial reactions of Dutch economists to resource discovery in the early 1960s. At the time, competition with other resources and the expectation of cheap nuclear energy led to the belief that gas reserves needed to be depleted quickly, with little thought for future generations. Finally, section 5 examines the more advanced and lasting reactions to the gas boom after the Dutch economy exhibited symptoms that could be ascribed to the resource curse, in the early 1970s. In the concluding remarks we present lessons to be drawn from the Dutch case for today's energy transition.

2. The Dutch Disease: definition and implications

The Dutch Disease is part of a broader set of phenomena usually gathered under the banner of the 'resource curse.' Although pioneering reflections upon the detrimental role of a natural resource boom on the economy can be found in the writing of 19th- and mid-20th-century scholars (e.g. Cairnes, Prebisch, Singer), the literature on the resource curse significantly developed from the late 1980s, with Alan H. Gelb's examination, for the World Bank, of the effects of oil discoveries on oil-producer countries (Gelb, 1988) and Richard Auty's first popularization of the term 'resource curse' (Auty, 1993). The literature took a turn in the mid-1990s with the first advanced quantitative investigations into the role of natural resources in promoting or disturbing growth. Sachs and Warner (1995, 2001) conducted cross-country econometric studies to measure the correlation between large endowments in resources and economic performance, confirming, in most cases, the existence of a curse. In the 2000s, further empirical estimates proved less conclusive, especially when institutional factors such as the rule of law, corruption, democracy and geopolitical stability were taken into account. All in all, the resource curse appeared more like a threat than an iron law, depending on the countries, their institutions and the historical configurations (Stevens and Dietsche, 2008; Frankel, 2010).

The literature on the resource curse boomed from the 1990s to the 2020s,[3] allowing for a richer understanding of the different mechanisms through which the curse could manifest. In 2010, Jeffrey A. Frankel summarized these mechanisms through six phenomena commonly associated with the resource curse: (1) the tendency of resource prices to decrease over time (i.e. Prebisch's hypothesis), (2) the risks of underinvestment in non-extractive manufacturing sectors after the boom, (3) the volatility of resource prices, (4) the risks of capture of resource rents by a small, ill-informed elite, (5) the tendency of some resource-rich countries to overinvest in military expenses at the expense of productive capital, (6) some monetary instability possibly inducing macroeconomic instability. The key message was that as soon as these

[1] On the history of the Centraal Planbureau as the main modeling agency of the Netherlands, see Kayzel (2019, 2021). In this paper we focus on academic economists, and do not include the more applied work of economists working for Shell, Esso, and other enterprises, unless it was published in major economic journals of the day. The role of those economists would require a separate investigation.

[2] The consulted archives were all located in the National Archives in The Hague. In total, seven different archival collections were consulted, from which circa 25 relevant boxes were selected, containing overall more than 3000 pages of archival documents, such as letters, drafts of (unpublished) reports, and minutes of meetings. A list of the archives consulted can be found in the bibliography.

[3] A 'resource curse' query on Google Scholar provides 262 references for the period 1991–2000, 8960 for 2001–2010, and 17,900 for 2011–2020. A similar query on the Web of Science provides 9 references for the period 1991–2000, 177 for 2001–2010, and 1195 for 2011–2020 (April 2023).

phenomena were well monitored, the curse could be turned into a blessing.

Among these phenomena, the Dutch Disease has been linked mainly to the second item, i.e. that of sectoral readjustments. As mentioned, the literature on the Dutch Disease actually predated that on the resource curse. When Corden and Neary (1982) published their seminal model describing the macroeconomic effects of a resource boom in a small open economy, they actually built upon previous work, especially Robert G. Gregory's examination of the effects of mineral growth on the Australian economy (Gregory, 1976). Their main innovation was to highlight the risks of de-industrialization, in response to the 1970s Dutch situation.

Generally and theoretically speaking, the Dutch Disease describes the macroeconomic effects of revenue windfalls coming from newly exploited resources such as oil and gas. In small open economies like the Netherlands, tradable sectors such as manufacturing are mostly dependent on their international competitiveness. When the boom occurs, it generates new revenues from the selling of resources, which provokes an appreciation of the real exchange rate, weakening the competitiveness of the whole economy, especially of the manufacturing tradable sector (Frankel, 2010; Van der Ploeg, 2011; Mien and Goujon, 2022). This sector has been proved to be one of the main drivers of long-run growth, because it is particularly subject to learning-by-doing, which implies that any under-investment today will adversely affect long-run productivity. The Dutch Disease is therefore likely to result in a long-term weakening of the economy, i.e. lower productivity and lower growth compared to no-resource scenarios, or de-industrialization (Van Wijnbergen, 1984; Krugman, 1987; Wick and Bulte, 2009). It has been suggested that the Dutch Disease could also be reinforced by the third of Frankel's aforementioned phenomena, i.e. the volatility of resource prices. After the boom, the economy becomes more and more dependent on its extractive sector, as the latter grows faster than the other sectors. As soon as the prices of resources may be more volatile than other prices, this might also create macroeconomic instability, due to the volatility of the revenues, for the extractive industry, and for the state through the tax levy (Davis and Tilton, 2005; Van der Ploeg, 2011).

The Dutch Disease describes a readjustment of the economy following an exogenous shock (i.e. a resource discovery). As such, it should not be considered a disease, rather a normal macroeconomic effect, as the economy adapts to its new characteristics and forces (Davis, 1995). What makes the Dutch Disease a disease is that it applies to *exhaustible* resources, which means that the windfall is temporary (i.e. until the resources start depleting). In case of exhaustion, after the revenues are gone, the readjustment of the whole economy might be painful, as the lagged manufacturing sector will struggle to catch up with international competitors and as the state will suddenly be deprived of the resources it got used to spend. In case the resources are still there but international prices become volatile, extraction can be slowed down and new energy-intensive industries might suffer, with macroeconomic consequences such as rising unemployment. This is what happened in the mid-1970s in the Netherlands: after the oil shock, the new policy of slowing extraction and the higher international energy prices made recent energy-intensive industries suffer while the previous generation of industries had gone; the state became more and more dependent on gas revenues, which would prove risky when diversification turned out to be even more imperative in the 1980s (Lubbers and Lemckert, 1980).

The theoretical literature emphasized two precise channels causing the Dutch Disease: the *spending effect*, and the *resource movement effect* (Corden and Neary, 1982). The spending effect is the most direct one, going through the appreciation of the real exchange rate following the resource boom. As mentioned, as more revenues are generated by the economy, the local currency appreciates, weakening the competitiveness of the other tradable sectors. The resource movement effect reinforces the disequilibrium: when booming, the resource sector attracts more and more labor and capital, making, ceteris paribus, these factors of production scarcer, and therefore more costly, in the other sectors. As a result, the competitiveness of these sectors is not only dampened by the real exchange rate, but also by increasing costs of production (Badeeb et al., 2017). In retrospect, empirical studies have shown that the resource movement effect was quite negligible in the Netherlands, especially because of the small inputs needed for gas extraction compared to the size of the capital and labor markets there (Kremers, 1986). Nevertheless, the theoretical models of Dutch Disease were able to distinguish the two effects right from the early 1980s.

Apart from the Netherlands, from the 1990s and 2000s onwards, empirical research showed that concrete cases of Dutch Disease revolved around different configurations according to the countries, both in developed and developing economies (Wick and Bulte, 2009; Van der Ploeg, 2011). Counter-examples, i.e. countries durably benefitting from their resources, were identified, including when resources had been depleted such as in Tunisia in the last decades of the 20th century (Davis, 1995). History shows that many countries actually did not fall into the trap of the Dutch Disease, starting with the United States, Canada, Norway, but also more recently Botswana, Malaysia and Indonesia (Stevens and Dietsche, 2008; Frankel, 2010). In the 2010s, the literature progressively insisted on the distinction between resource *abundance* and resource *dependence*, the former emphasizing the stocks of resources available, the latter the share of resource exports in total GDP. It appeared that excessive specialization in the resource sector was more responsible for the occurrence of the Dutch Disease than large resource endowments (Badeeb et al., 2017). Successful countries were able to use their resources progressively in order not to become too dependent on them, and what mattered the most was the use of the resource revenues: Norway has been given as an efficacious case, devoting a large share of the oil revenues to a sovereign fund enabling diversified investments, locally and internationally (Wick and Bulte, 2009). Already in the 1980s, commentators such as Van Wijnbergen (1984) emphasized the importance of the recycling of the resource rent, echoing the literature on exhaustible resource economics then developing (Hartwick, 1977; Dasgupta and Heal, 1979). In order to make good use of the resource boom, the revenues had to be reinvested for the long run and not roughly consumed in the short run. This is probably one of the main criticisms retrospectively addressed to the Dutch government: using the gas windfalls to fund social policies in the 1970s was not the best way to build a sustainable economy (Van der Ploeg, 2011).

It has been argued that the gas boom was not the only cause of the allegedly bad decisions made by the Dutch authorities, as there had been a general call from the Dutch society for the development of the public sector in the Netherlands for twenty years – the priority given to short-run social policies might have occurred anyway, even if it has certainly been reinforced by the gas windfalls (Frijns, 1986; Kremers, 1986).

These assessments, like the theoretical explanations of the Dutch Disease syndrome given after the 1980s, are all retrospective, paying little attention, in the end, to the reactions and perceptions in situ of Dutch economists, from the turn of the 1960s to the late 1970s. In particular, did Dutch economists anticipate at least part of the macroeconomic readjustments subsequently identified in the literature? What work did they do at the time to guide, or on the contrary to challenge, the policy choices of the Dutch government? These are the questions we are now turning to.

3. Dutch economics and the energy situation in the 1950s

Industrial policy in the post-war Netherlands aimed at achieving competitiveness by keeping wages and domestic prices lower than in other Western European countries. This policy was successful and contributed to the growth of the Dutch economy in the 1950s (Van Zanden, 1997). As a corollary, overall consumption levels, including those of energy, were lower than in surrounding countries. During the 1950s, the energy consumed in the Netherlands largely was produced by coal, with a growing role for oil (Hölsgens, 2016). Prior to the Second World War, the Netherlands had had access to cheap oil from the Dutch

East Indies colony, where the Anglo-Dutch company Royal Dutch Shell was active, but this resource was lost after Indonesian independence (Schot et al., 2000; Howarth et al., 2007).

Prognoses of energy use and population growth in the Netherlands tended toward pessimism in the 1950s. The Dutch case was not isolated. All over Europe, there were fears about the long-run availability of energy resources, especially in the context of post-war reconstruction. In France for instance, the domestic coal industry soon entered a declining phase and securing oil reserves came up against legitimate pro-independence movements in colonized areas such as Algeria – it was not until the 1960s and 1970s that France's electro-nuclear program emerged as a credible alternative for providing energy supply (Beltran et al., 2009). In the United States, the new international order raised concerns for the future of energy resources. This led to the Paley Commission, established in 1951 to investigate the availability of resources both in the country and abroad (Paley, 1952). Economists and natural resource experts then gathered in research bodies such as Resources for the Future to continue exploring ways out of the forecasted scarcity of resources (Goodwin, 1981; Turnbull, 2017). Forms of optimism only appeared in the 1960s, on the basis of empirical works by economists arguing for the ability of markets and pricing systems to counterbalance the scarcity of resources (e.g. Barnett and Morse, 1963). This was also the time when the idea of infinite growth was consolidated, the question of natural resource having been supposedly solved, at least theoretically (Solow, 1956, 1974; see Albritton Jonsson and Wennerlind, 2023; Gaspard and Missemer, 2023).

Back to the 1950s, in the Netherlands, a growing energy demand from the rapidly expanding industrial sector and population created concerns about energy dependency. Not least among these concerns was increased energy use due to motorization. The prospects of increasing domestic production of primary energy sources (mostly coal from Limburg province) were very limited. While the Dutch Petroleum Company (NAM, a joint venture of Shell and Esso created in 1947) explored the Netherlands for oil and gas reserves, the very small findings did not lead to optimism about energy independence. The NAM found a small oil field, as well as isolated natural gas reserves in the east of the Netherlands, but the overall dependence on coal and oil pointed to growing imports in the near future. There were few if any expectations that natural gas could play a significant role in addressing shortages and import dependency: after the Second World War, energy dependency steadily increased until only 40% of consumption was covered by domestic production in the early 1960s. The discovery of natural gas would change all this, and net self-sufficiency exceeded a 100% by the end of the decade (Hölsgens, 2019, 46).[4]

Two reports from the 1950s provide insight into Dutch economists' view on this matter. The first is a publication on the future energy provision in the Netherlands, jointly produced by economists, engineers, and energy enterprises in 1952 under the banner of the Dutch Royal Institute of Engineers (KIVI). The committee writing the report contained economists from the Central Planning Agency (Martin Ekker, later replaced by Henri Foyer), as well as leading figures from the Dutch State Mines, the Dutch Railways, and electricity and petroleum companies.[5] The main parts of the report are dedicated to predicting future energy demand, the possibility of providing this demand, and ways of limiting energy use or improving energy efficiency. Extrapolating from the energy use in the 1920s and 1930s, the report argued that by 1960 energy demand would far outstrip domestic coal production.[6] Given the highly efficient production already in place in Dutch mines (due to the early introduction of scientific management), raising production through mechanization or other measures would not lead to major production increases. Being skeptical about the availability and affordability of European and American imports, the report's main recommendation was to focus on energy efficiency and energy-saving measures. Saving fuel (*brandstofeconomie*) was not an immediate need for individuals, as it had been for many during World War Two, but it was urgently called for on a national level. The bulk of the report was therefore dedicated to technical solutions for increasing energy efficiency in large energy-consuming sectors (Koninklijk Instituut van Ingenieurs, 1952).

A second, equally pessimistic publication, is a 1958 volume collecting the papers given during a 1957 symposium at the University of Amsterdam on 'energy and population growth.' 10 professors of various backgrounds considered the issue, including two economists: Jan Tinbergen and the Dutch monetary theorist Johan Gerbrand Koopmans,[7] a professor of public finance at the Rotterdam School for Economics.[8] In his contribution, Tinbergen, following alarming European publications about future energy shortages, called for energy price increases:

> "[Energy scarcity would] in the long run find its natural expression in higher prices of energy in comparison to other goods. While for solving temporary difficulties one could maybe use and recommend measures like distribution, for lasting difficulties leaving prices at a low level would be the wrong policy. Users of energy who would not be impacted by distribution would be insufficiently reminded of the fact that in using energy they *in fact destroy more value in consumption than they reimburse through their payments.* The necessity of frugality would not be felt sufficiently. A rise in prices is the natural means to stimulate this frugality and such a rise could possibly be desirable before the scarcity would become acute." (Tinbergen, 1958, 29, italics added)[9]

Like the KIVI report, Tinbergen also reflected on the possibility of saving energy.[10] Raising energy prices, especially for the use of fossil fuels in industry, was the best instrument to achieve this in his opinion. Tinbergen believed that in countries with high levels of consumption like the US, saving energy on motorized transport and residential heating was necessary. However, on the whole, "energy savings will have to be achieved to a considerable extent in the business sector. But here too, no more powerful lever than a price increase is conceivable. The price increases discussed above could be differentiated according to the type of energy consumed and applied in particular to the exhaustible types" (Tinbergen, 1958, 33). Tinbergen did not elaborate on this last point.[11]

In a similar vein, Koopmans also was highly pessimistic about the long-term energy future, but he came up with a more detailed analysis and proposal than Tinbergen. While evidence for future scarcity was mounting, in his view, "public opinion still appears to be little aware of

[4] There were still oil imports, since gas could not be used for all functions oil fulfilled, but given the profits from exports of gas, the Netherlands briefly became a net exporter in the 1970s.

[5] Draft texts by Foyer of some of the forecasting done in the report can be found in the CPB archives (National Archives, 2.06.093, inv. no. 393).

[6] As the report also showed, in 1938 the Dutch coal mines still exported a significant amount of coal. After the Second World War, almost all coal was consumed domestically (p. 7).

[7] Johan Koopmans was not immediately related to Tjalling Koopmans as far as we know.

[8] The other contributions came from disciplines like physics, chemistry, mining, law, and sociology.

[9] Translations from the Dutch are by the authors.

[10] For instance, in the American case, by limiting widespread car use, partly by making public transit cheaper; as well as by saving on heating by accepting a somewhat lower living standard. This call for a more sober life style was reflective of Tinbergen's overall life philosophy, as Erwin Dekker's biography argues (Dekker, 2021).

[11] Tinbergen's contribution to the topic seem relatively limited, although he did publish a 1973 paper on resources and exhaustion (Tinbergen, 1973).

the seriousness of the problem," and he was surprised that "an almost incomprehensible optimism – in recent times fueled mainly by the spectacular 'miracle' of the peaceful application of nuclear energy – prevails not only among laymen, but also among many who could know better" (Koopmans, 1958, 82). Koopmans argued that the issue was so urgent that policy interventions in energy were necessary. He agreed with Tinbergen that manipulating energy prices was the best instrument to encourage energy savings in industry, but he was more interested in a policy of price differentiation for various types of energy. Koopmans's goal was to create "substitution effects" to "other forms of energy production than those from 'exhaustibles'" (Koopmans, 1958, 91-92), which is reminiscent of some American conservation proposals put forward in the 1920s to foster substitution to non-exhaustible resources (e.g. Ise, 1925; see Missemer, 2017). Renewable energy was crucial "to justify any optimism in the long term. *After all, these are the only processes, where energy becomes available as 'income' and no energy 'capital' is affected* [...] in other words, where in a broader economic sense no 'disinvestment' [*desinvestering*] or 'de-saving' [*ontsparing*] or, as it is usually called in the narrower context discussed here, no '*depletion*' takes place" (Koopmans, 1958, 88, italics in original).[12]

Koopmans invoked the terminology of welfare economics, which distinguishes private from social costs and benefits, to argue that energy producers determined prices solely based on the input of other sources of production (labor, capital in the form of machines, etc.) but "not a discounting sum [*afschrijvingsbedrag*] for 'depletion'", which means that "the interests of future generations" were not taken into account in current energy prices (Koopmans, 1958, 94). Leaving price-setting to the market would mean prices would always lie below the 'social cost' of depleting exhaustible resources. Since Koopmans believed it was not commercially attractive for speculators to buy stockpiles of resources as a means of saving resources for future generations, it was left to the government to intervene in the energy market. Here again, we can make connections between the Dutch discussions and economic debates taking place elsewhere, as Koopmans's take on the social cost is reminiscent of K. William Kapp's *The Social Costs of Private Enterprise* (Kapp, 1950), published in the United States a few years before.

To solve the issue, Koopmans came up with a thought experiment about ideal policies – what could a 'World Energy Board' do if it would not have to reckon with national interests or lobby groups? Governments could achieve 'underground stockpiling' by reserving funds for the exploitation of less profitable mines, which would otherwise be exploited later commercially.[13] Acting as agents of future generations, governments would in this way increase scarcity in the present, driving up prices, thereby lowering consumption and indirectly stimulating substitution, thus guaranteeing *less* scarcity for future generations. As far-reaching as this intervention in the market would be, Koopmans argued the ends justified the means. However, while this radical measure would increase prices and possibly lead to energy savings, Koopmans argued it would "not create a direct incentive to substitute as much as possible current energy use by less or non-exhaustible resources" (Koopmans, 1958, 102). He preferred a system of royalties to be levied upon energy producers which would discount for depletion (and which would differ per energy source). Every owner of an exhaustible energy source should be "levied with such sums of money (royalties) per unit of raw material produced, that thereby the 'misalignment' of the price compass – which, as we saw, consists in not taking into account a factor for 'depletion' – is eliminated" (Koopmans, 1958, 103). This income, to be put in a "replacement fund," should then be invested in renewable energy sources (hydro, tidal, and solar energy) and nuclear energy, an idea which can be related to the sovereign funds that would be introduced later, in Norway for instance. With remarkable prescience, Koopmans was convinced that only increasing the prices of exhaustible energy would incentivize enterprises to move away from fossil fuels.

In short, both Tinbergen and Koopmans believed that leaving the setting of energy prices entirely to the market would have adverse societal effects in the long run. Guaranteeing energy security (not specifically in the Netherlands, but globally) would necessitate energy savings and some form of (inter)national price policy for energy, which could take different forms. The idea that increasing energy inputs was a necessary condition for economic growth was not questioned, although the rising energy demand was seen as very problematic in the long run. In microeconomic terms, engineers extensively thought about improving mining efficiency (limited potential in the Netherlands) and energy-saving measures in other domains. Finally, economists like Tinbergen and Koopmans tried to influence government policy by calling for more proactive policies to safeguard the interests of future generations. This concern largely disappeared in the 1960s as economists and policymakers were swept up in a wave of optimism that halted reflection about the problematic dependency on exhaustible resources in the long run. Because of the discovery of natural gas reserves in the late 1950s, the Netherlands experienced a particularly major shift in this regard.

4. First reactions to the gas boom in the 1960s

In 1959 oil and gas exploration in the Netherlands paid off spectacularly with the discovery of the Groningen gas fields around Slochteren, in the northeast of the Netherlands. Although the size of the discovered gas field only gradually became clear (indeed, the uncertainty about the available resource was a major source of difficulty in determining prices and exploitation rates), this was a major success for the efforts of the NAM (the Dutch Petroleum Company).[14] Negotiations between the Minister of Economic Affairs, Jan Willem De Pous (in office 1959–1963), and the commercial partners (Shell, Esso, Dutch State Mines) led to an agreement (the Gas Memorandum of 1962) in which the gas price was linked to that of oil. Dumping gas at low prices would not only lead to lower revenues, it would also disturb energy markets and aggravate the difficulties of the coal sector. Since Shell and Esso were oil companies, and the state-owned DSM was a mining company, these parties had no interest in harming their main business model with overly cheap gas. A smooth, non-disruptive introduction of gas into the market was crucial. Nevertheless, prices were set somewhat lower than those of competing fuels, to ensure it would be attractive enough for households to use the gas for heating.

A crucial assumption by economists and decision-makers was that the total depletion of the gas reserves should take 25–40 years. This was mainly due to optimistic expectations about the development of nuclear energy: policymakers believed that cheap nuclear energy meant gas could not be sold at high prices in the long run. In addition, there was the concern that the large investments required for constructing a gas distribution network needed to be recouped (Kaijser, 1996). To provide gas to households, in a very short period in the early 1960s a nationwide network of gas pipelines was constructed, and household appliances for cooking and heating had to be made suitable for functioning on Groningen gas (Schot et al., 2000). Gas prices were differentiated, with households paying a much higher price than industry. As a result of the gas boom, the energy intensity of the Dutch economy doubled between 1963 and 1973, at a time when it was declining in most industrial

[12] Koopmans used the English terms 'exhaustibles' and 'depletion' (in the next quotes), rather than Dutch equivalents. The concepts translated here as 'disinvestment' and 'de-saving' are neologisms in Dutch.

[13] Koopmans was rather vague on how he envisioned this, perhaps intending heavy subsidies for enterprises to favor this type of exploitation and leave richer coal seems or oil wells undisturbed for the moment.

[14] The British economic geographer Peter Odell, who lectured at the Rotterdam School of Economics from 1968 to 1991 was one of the most outspoken advocates of abundance of oil and natural gas, arguing against skeptics that available reserves were much larger than generally assumed. See e.g. Odell, 1969, 1980.

countries (Van Zanden, 1997, 164). The availability of cheap gas stimulated the development of new energy-intensive industries and agriculture, like aluminum production and greenhouse agriculture. The revenue arrangement between the state, represented by the state-owned company DSM, and the commercial partners Esso and Shell changed over time, with the Dutch government receiving most of the proceeds through a combination of direct revenue and taxes (eventually rising from 70% to 95%), contributing significantly to the Dutch public budget. The details of these arrangements were often not made public, as Shell and Esso were also negotiating with OPEC countries at the time about distributing oil revenue. In the Dutch case, they were willing to allow the state a larger share of revenue than the oil countries, but this had to remain secret not to hinder negotiations with OPEC (Schot et al., 2000, 209; Garavini, 2019). In absolute numbers, the income from gas rose sharply in the 1970s until a peak in the mid-1980s, and its contribution to GDP rose from less than 1% to 5% in the 1970s (Wierts and Schotten, 2008, 10).

Most Dutch economists who wrote on the discovery of gas in the 1960s focused on the short-term, which might raise the issue, still today, of the shortsightedness resulting from the massive discovery of energy or mineral potential. Given the need to determine optimal prices, the expectation of a relatively short exploitation period, and a severe underestimation of the amount of gas, reflections on the macroeconomic impact of the discovery were quite limited but not non-existent. The primary concern was determining how gas would most optimally contribute to the public budget and national income in the short term. The most prominent economist to reflect on the matter at this early stage was Pieter de Wolff, the director of the Central Planning Agency (CPB). As the director of the main advisory economic council to the government, he was quite influential at the time with Dutch policymakers. De Wolff had studied with Tinbergen in the 1930s and worked under him at the Dutch Statistics Agency. After working for Philips's market research division and the Amsterdam municipal statistical office, he directed the CPB between 1957 and 1966 before becoming a professor of econometrics.

The central concern for De Wolff, and many other economists writing about the topic in this period, was "how natural gas should be utilized to yield the greatest possible benefit [*nut*] to the national economy" (De Wolff, 1964, 3). For De Wolff, this meant calculating the total profit that could be made over the period of extraction, plus the "consumer surplus," amounting to total welfare. This was complicated because of uncertainties about the amount of gas, the development of energy use, and the interest rate. De Wolff strongly endorsed, and contributed to the adoption by the Dutch government of, the aforementioned timeframe of exploitation of 25–40 years. He argued that natural gas had the potential to boost the Dutch economy significantly, firstly by freeing up domestic production factors, and secondly by improving the balance of payments by reducing the need for energy imports.

Regarding the first point, given the lower production costs of gas compared to coal and oil, and the relatively limited amount of labor needed to produce it, capital and labor would be saved. If used productively for other purposes, the overall economy would improve. De Wolff believed that this tended to happen automatically in the long run, but to profit fully from the extra capacity in the short run policymakers had to intervene. Interestingly, we can note that this macroeconomic effect anticipated by De Wolff was almost the opposite of what subsequent resource curse scholars identified as the resource movement effect, as we reviewed in section 2. This means that Dutch economists did predict possible movements of factors of production resulting from the energy boom right after the initial discovery in 1959, yet not from non-extractive sectors to the resource sector but from the energy sector to the rest of the economy, which suggests that the understanding of theoretical mechanisms can sometimes be biased by over-optimistic underlying assumptions.

Secondly, in the early 1960s, the balance of payment was neutral, but with gas, a surplus could be created (De Wolff, 1964, 2–3).[15] Here De Wolff anticipated what would later become known as the spending effect, showing again the ability of economists in the 1960s to consider the macroeconomic implications of energy dynamics. De Wolff did not specify the underlying calculations of his energy model, but he believed in a link between energy input and economic growth. Given the expected growth of national income with c. 50% in ten years, energy demand would increase by a similar percentage. De Wolff also speculated that cheaper energy could increase demand and therefore lead to energy demand rising faster than the rates of economic growth (De Wolff, 1964, 9).

Regarding industrialization policy, De Wolff had ambivalent feelings about using gas for new energy-intensive industries, questioning the role of the state on this matter:

> "We live in a society, which in terms of economic organization is usually referred to as mixed. In it, the government has the power to intervene in economic life through a number of clearly defined instruments such as taxation, governmental spending, monetary policy and wage and price policy, and it also makes deliberate use of them to achieve certain goals, which include the growth of national income. But the distribution of goods and services and the allocation of the factors of production are carried out by means of the price system. Direct allocation by the government, which plays a major role in fully managed economies, for example, is not applied in our system and that of our neighboring countries, or is applied only exceptionally." (De Wolff, 1964, 5)

Setting prices was fitting in a mixed economy like the Dutch one, but a policy of energy allocation to various sectors was a form of state intervention that had no place in a market economy, and was also not the best option in terms of maximizing national income. There could be reasons to do it nevertheless: as Minister of Economic Affairs De Pous had also argued, providing cheap energy could be an effective policy to stimulate industrial development in lesser developed regions (De Wolff, 1964, 21–22). This was typical of a wider concern of Dutch economists with the issue of regional development and the fair national distribution of benefits of the gas.

De Wolff was not the only Dutch economist engaging with energy issues in the 1960s. Bram de Boer, an expert on the prices of nuclear energy, and in the early 1960s an official for Euratom, argued in 1963 that a profit maximization policy was not in the national economic interest. Striving for high profit margins meant a lower production level to drive up prices. For the economy, abundant availability of cheaper gas would be better. At the same time, he also admonished against overly low prices: these would hurt coal and other sectors of the economy and not create a net benefit at the level of the economy as a whole. As someone who looked at energy futures at a European level, and as an advocate of nuclear energy, De Boer argued against fundamentally changing the structure of the economy or energy provision, since this was not sustainable. Cheap nuclear energy might be a fierce competitor, and in any case, looking at natural gas from a national perspective was dangerous as European developments, or cheap gas from other parts of the world, could have an impact on export strategies. A measure of coordination at a European level was called for, which in retrospect strongly echoes today's debates on coordination issues within the European energy market. In a short 1963 article De Boer made an effort at estimating the macroeconomic impact of an influx of cheap gas on the

[15] Strikingly, De Wolff suggested not just using this surplus to stimulate the national economy, but also mentioned the option of spending more on developmental aid, as an indirect way of benefiting the Dutch economy.

market which can be retrospectively considered as an early awareness of the macroeconomic mechanisms that could play a role in Dutch Disease-like syndromes (De Boer, 1963).

To conclude, in the 1960s the concerns of Koopmans and Tinbergen were seemingly forgotten, as the energy situation seemed to switch from scarcity to abundance – this was a general trend in Western countries but happened in the Netherlands in proportions unmatched anywhere else because of the domestic gas discoveries. The expected increase of state revenue and shifts in the economic structure were reasons for some prominent economists like De Wolff to try and estimate the macroeconomic effects in the short-to-medium run. Reflections on the situation after gas reserves would run out were less common. Nevertheless, there were continuities: De Wolff's reflections show that thinking about energy was a way for economists to think through the issue of appropriate levels of state intervention in the economy, continuing in the vein of Tinbergen and Koopmans in the 1950s. Energy took up an intermediate position: there had historically been state involvement in the form of the Dutch State Mines, and the ministry of Economic Affairs responsible for energy and industrialization. The post-war period in the Netherlands was also characterized by a strong influence of social-democratic planning ideals. In their texts these economists went to some lengths to defend this state intervention.

5. Dutch energy economic thinking in the 1970s

After the rapid depletion rates of the 1960s, Dutch energy policy in the 1970s shifted. A lower extraction rate of natural gas, the formation of a strategic reserve, and sobriety in the use of gas became policy goals. The decision to slow down extraction predated the oil crisis and was primarily motivated by growing awareness of the exhaustibility of resources and environmental considerations.[16] Lower production did not mean less income though. Since the gas price was linked to the oil price, income from gas in the 1970s rose sharply as oil prices went up, substantially increasing the contribution of gas to national income and making the issue of how to spend this revenue more visible and pressing (Wieleman, 1982). The relative lack of other domestic energy resources, and the slow progress on nuclear facilities, all meant that depletion rates were slowed down and prices moved up. These reflections were also partly prompted by de-industrialization which had started to manifest itself in the second half of the 1960s.

Dutch economists increasingly criticized the shortsightedness of 1960s writing on gas. Some economists suggested that policymakers needed to take temporal discounting more into account (Zijlstra, 1974). The best example is an article by S. Koorn, head of the CPB's Traffic and Energy department. In 1974 he criticized his predecessor at CPB, Pieter de Wolff, stating that it was "unfortunate that in that speech he only considered how to achieve the greatest possible contribution of natural gas to the national income during the period of extraction, leaving out the period after depletion" (Koorn, 1974, 1121). According to Koorn, economists in the 1960s only asked themselves how to maximize profits, but not how these profits were to be spent best. Finding a resource like this was like winning the lottery, and "we usually find wiser the one who considers how to derive lasting pleasure from his new wealth as much as possible, and who is therefore concerned with the preservation of his assets" (Koorn, 1974, 1121). It had been shortsighted and negligent of Dutch policymakers and economists not to think more about how to benefit in the long run from this resource boom.

This article is one of the first serious reflections on what the influx of gas profits into the Dutch economy meant. Koorn's main argument was that immediately spending large amounts of profits had raised government expenditure in the short term in an unsustainable fashion: when the natural resource inevitably was depleted, the government would have to radically cut down on spending and a period of painful austerity would commence. Instead, by wisely investing or setting aside parts of the profits, the government should guarantee that the higher level of expenditure that had arisen would be sustainable after the exhaustible resource had run out. In other words, Koorn drew attention to the fact that a resource boom did not just entail macroeconomic readjustments, but could be considered a temporary fix for a struggling economy, which would be an argument of the subsequent Dutch Disease literature.

Koorn argued that, to the extent that gas profits were to be spent in the short-term, they should be invested in infrastructural projects strengthening the structure of the economy, an argument echoing old ideas of compensation for depletion that we can already find in 19th-century discussions of the coal question (Jevons, 1865; see Missemer, 2012) and that were about to be substantially developed by the Hartwick rule literature (Hartwick, 1977). The infrastructural projects Koorn proposed investing in were alternative energy sources, a second airport, and the postal service responsible for extending the telephone network. If no such projects were available, the money should be put into a fund, invested wisely, and saved for a future generation, which in this way would also profit from the gas boom – again, precisely what Norway would do right from the 1980s. Koorn did not explicitly mention options such as investing in diversifying the industrial base, education, or other measures that could have improved the structure of the Dutch economy in a gas-less future, but he was moving in this direction with these reflections in the mid-1970s.

A second critical voice came from Johannes Weitenberg, deputy director of the CPB and a professor of public finance at Groningen University. In a 1975 article, he observed a growing number of concerns. Firstly, enterprises started to complain about the strong Dutch currency and its adverse effects on an open and export-oriented economy; secondly, Koorn had re-introduced the argument of inter-generational fairness in the distribution of gas profits to the debate already brought up by Tinbergen and Koopmans in the 1950s, while thirdly, Minister of Economic Affairs Ruud Lubbers had worries that the accidental resource boom masked fundamental problems in the Dutch economy (Weitenberg, 1975).

The wider circulation of these emerging concerns can also be observed in a 1976 lecture by former Minister of Economic Affairs De Pous. After his time in office, he became chairman of the Social-Economic Council (SER), a key advisory government body. In a lecture reflecting on the state of the economy in 1976, he argued that there was an urgent need to employ the gas profits to strengthen and diversify the Dutch industry and guarantee its long-term health and status as an employer (SER, 1976; De Pous, 1980). De Pous asserted that the Dutch economy had become reliant on very energy-intensive sectors (i.e. chemical industry, heavy metals, and greenhouse agriculture). Industrial development in other sectors lagged behind. In 1976 he called for investments in education, technological innovation, and the service sector. A lack of incentive to innovate, and underfunding of education have become known as two features of the resource curse, which De Pous identified before the Dutch Disease concept was introduced in 1977 (Frankel, 2010; Van der Ploeg, 2011; Mien and Goujon, 2022). In his 1976 lecture, De Pous explicitly compared the gas profits to the Marshall Plan which had restructured the Dutch industry in the postwar period, calling for sound state intervention for the management of resource revenues:

> "National natural gas capacity could make an important contribution to strengthening the capital structure of companies and financing the necessary expansion of the production apparatus. One could imagine that a significant part of the state's natural gas revenues – in 1975 almost 6 billion guilders, rising to about 9 billion guilders in 1977 and 1978, after which there will be a gradual decline – would not flow into the general resources, but would be set aside in a fund. The resources flowing into this fund – for 1976 in the order of 2 to 3

[16] The oil crisis probably impacted the discourse as well, since it had noticeable and highly visible effects in the Netherlands, although in the final analysis economic impact was probably rather limited (Hellema et al., 2004).

billion guilders, to give you an idea – could be used for the financial strengthening of companies and the physical development of the production apparatus through the provision of risk-bearing and risk-averse capital to industry (shares, subordinated loans and other – also new – forms of financing). Thus, at least in part, the natural gas revenues would be transformed into new productive national assets, as was the case with the Marshall Aid funds. The board of this fund could be composed of government representatives and members drawn from entrepreneurial and worker circles." (De Pous, 1980, 25)

This was quite a far-reaching proposal, in line with earlier thinking about state involvement in energy policy from Tinbergen, Koopmans and De Wolff. Not specified further, this proposal would have entailed a degree of planning with which De Wolff probably would have disagreed in the 1960s. It also shows the substantial evolution of De Pous' thought versus his stance in the early 1960s, and more broadly the ability of economists and policymakers to adapt to unfulfilled initial expectations.

In short, after scattered reflections in the 1960s, the implications of the gas boom increasingly preoccupied economists in the mid-1970s. While it is true that, on the whole, economists were more concerned with issues like monetary policy (Mellink and Oudenampsen, 2022), they did not neglect energy issues entirely. At the same time, economic reflections on energy were sometimes lacking in places where one might expect them. In 1976, for instance, the yearly essay collection of the professional economists' association was dedicated to "the energy question" but contained no analysis of resource issues (Vereniging voor de Staathuishoudkunde, 1976). Most contributions were in fact geological and technological rather than economic.[17] It is telling that the editors could not find someone willing to take on the assignment of writing an essay on the relationship between industry and energy politics. All that they provided was a bullet-point style article by Adriaan Pieter Oele, president of the General Energy Council (*Algemene Energieraad)*.[18] Despite the unfavorable outlook of the energy-intensive sector in the Netherlands in the long run, and growing environmental concerns, he still argued against an industrial policy that would limit the sector. According to Oele, energy use between 1975 and 1985 would increase by 50% to 60%, which would increase import dependency by 46% to 70%. Natural gas would diminish in national energy provision from 50% to 30%, while dependency on oil would increase. Despite these pessimistic conclusions, Oele saw no urgent need to restructure industry and only recommended that "in the somewhat longer run the transition to less energy-intensive production with larger added value will be necessary" (Oele, 1976, 124). In the short run, saving energy in other ways was more important. His main argument against downsizing the energy-intensive sector was that the chemical and steel industry, including its various dependent sectors, employed about 10% of the entire Dutch population, making it socio-economically problematic to lessen its impact, an argument which echoes some of the considerations around the socio-economic effects of the closing of coal mine in Western Europe at the time, such as Belgium (Baeten et al., 1999), and more recent debates about getting out of polluting and CO_2-emissive industries (Geels and Turnheim, 2022).

To sum up, in the 1970s, some of the concerns of the 1950s economists resurfaced. The exhaustibility of gas came into focus more and as a result inter-generational fairness returned to the agenda, both in the form of concern about the rate of depletion, but also about the optimal use of the revenue and the potentially painful readjustment when profits would dry up. Intellectually, the growing attention to scarcity and environmental degradation contributed to this, while in economic terms the rising share of gas revenues in Dutch state budgets made the question of macroeconomic impact more urgent. In the early-to-mid 1970s therefore, Dutch economists started to formulate some of the negative impacts of this resource: the austerity measures that might be necessary after the resources had run out, the declining competitiveness of the Dutch export sector, and the overall dependence on energy-intensive sectors in a context of rising energy prices and fears of scarcity. Many of these elements have become key features of the Dutch Disease and resource curse literature.

6. Conclusions: past and present

After 1977, Dutch economists progressively engaged in the reassessment of the situation following the 1960s energy boom.[19] In 1979, Maria Brouwer, an economist at the Foundation for Economic Research (*Stichting Economisch Onderzoek*) at the University of Amsterdam, explicitly asked whether gas was a curse or a blessing. She argued that the Dutch government had done nothing to strengthen the international position of the Dutch economy as its position grew worse (Brouwer, 1979). In 1981, Michael Ellman, a professor of economics at the University of Amsterdam, concluded that natural gas exports had had negative effects on State budget income, caused balance of payments issues, influenced the exchange rate, and altered the structure of the economy (Ellman, 1981). A 1984 article by the economist Henk Peer addresses the matter of gas prices from the viewpoint of scarcity and inter-temporal allocation (Peer, 1984). Although this topic had been introduced in the Netherlands in the 1950s by Tinbergen and Koopmans, as we have shown, it did not feature prominently in economic debates in the 1960s. Using considerations that sound similar to the famous sustainability definition that would be employed some years later in the Brundtland report, Peer argued for the need to calculate user costs in a way that incorporated the "sacrificed opportunities" of future generations.[20]

To summarize the period from the 1950s to the 1970s, it is clear that economists' analysis of the natural gas situation was influenced by the wider context of economic developments. Strong pessimism about energy shortages in the 1950s was temporarily dispelled by the gas discovery in the 1960s, only to return in the 1970s. Dutch economists struggled with theorizing optimal exploitation rates and other aspects of the gas boom in the context of large uncertainties about the amount of gas and the future of industrial development and energy consumption. Calls for raising energy prices and forcefully achieving substitution and transition in the 1950s were followed in the 1960s by attempts to set prices in a way that both reacted to the market (by coupling it to the price of other energy sources) while also maximizing profitability through differentiated rates. At the same time, the use of proceeds from natural gas was not a pressing topic of discussion until the 1970s, when the criticism of misspending and shortsightedness started to come to the fore.

Over the entire period of study, we argue that economic thinking about energy was quite dynamic and evolved over time. Even an individual figure like De Pous changed his opinion quite drastically between the early 1960s and the mid-1970s. Moreover, this was no linear story. The 1960s optimism forms a parenthesis since the 1950s and 1970s

[17] This can be related to the long-run history of energy issues in economics, with many episodes where economic discussions were in fact conducted by engineers and geologists (Missemer and Nadaud, 2020; Russ, 2020; Giraudet and Missemer, 2023).

[18] The General Energy Council was an advisory council for energy issues broadly conceived, and consisted of representatives of many different sectors and interests.

[19] The term 'Dutch Disease' was used in articles in Dutch economic journals in the 1980s (Van Laer, 1981; Kamps, 1983), but the direct reactions of Dutch economists to the introduction of the expression by *The Economist* in November 1977 is unclear. A specific analysis of the Dutch press and media over 1977–1978, which is beyond the scope of this article, could perhaps provide some clues in this respect.

[20] Given scarcity concerns, and stalling progress on nuclear energy, reintroducing coal was also seriously discussed again around 1980 (e.g. Tieleman, 1980; Van der Hoeven, 1980).

shared more pessimism about energy. The ideas put forward by Tinbergen and Koopmans in the 1950s retrospectively appear as particularly pioneering in terms of energy pricing and resource substitution in order to foster renewables and energy efficiency. Dutch economists, in particular De Wolff, did identify some macroeconomic effects of the resource boom, including forms of resource movement and spending effects. There was therefore a certain amount of clairvoyance about the mechanisms of the Dutch Disease as early as the 1960s, although some mechanisms were not fully understood correctly (e.g. the direction of the movement of production factors). This is a lesson for today: optimism can sometimes skew the view of economists who have successfully identified the right macroeconomic transmission channels between the energy sector and other sectors of the economy.

Exploring the Dutch reactions to the discovery of natural gas reserves in the 1960s and 1970s provides insights for addressing today's energy transition. Discoveries of fossil fuel reserves and their macroeconomic consequences remain topical issues in many countries around the world. In a context of climate change and expected declining fossil fuel demand, investments in coal, oil and gas could quickly turn into stranded assets (Mercure et al., 2018; Daumas, 2023), with similar effects as resource exhaustion in terms of macroeconomic stability. One lesson from the Dutch case is that a resource boom should not, contrary to what was promoted by Dutch experts in the 1960s, be converted into over-specialization in the extractive and energy-intensive sectors. Economic diversification should remain a priority, for instance by subsidizing (with the resource rent) industries that existed before the boom. In Mozambique for instance, the traditional textile industry has experienced many transformations for several decades, including under colonial rule (Clarence-Smith, 2014; Naeem and Siddique, 2023). With the recent discovery of gas reserves, foreign investment led to a boom of the extractive sector, at the relative expense of other industries and economic activities (Dietsche and Esteves, 2020; Carrilho et al., 2021; Salite et al., 2022). Maintaining and developing a renewed, nationally determined Mozambican textile industry, among other manufacturing sectors, will be a real challenge, but one probably worth taking up in light of history. Similar lessons from the Dutch case could also apply to other economies today over-dominated by fossil fuel extraction such as Algeria and Venezuela, and also to countries where recent gas and oil discoveries could be a temptation to turn away from green investment programs (e.g. Senegal, Brazil). Since the 1960s, the context has changed and economists now recognize that international specialization in just a few sectors (in the tradition of the Heckscher-Ohlin-Samuelson paradigm) is not always the best option for domestic long-run development (Krugman, 1991). In a context of climate change and planetary boundaries, in which resilience and diversity in both ecological and economic terms are about to be critical, this is even more true.

With respect to renewables, our inquiry suggests that resource booms (e.g. for critical minerals such as lithium and rare earth metals), and related technological options, should be approached with some caution when they pop up. Biofuels a few years ago, photovoltaic and offshore wind in the 2010s, and more recently hydrogen, have been successively presented as new bonanzas, with potentially new opportunities for well-endowed countries. The Dutch economists of the 1950s and 1960s remind us that when it comes to natural extractive resources, certainties are short-lived. A variety of technological options, in line with 21st century climate objectives, should therefore be retained in today's economic mid- and long-run scenarios.[21]

Exploring the history of economic thought to address contemporary challenges regarding the energy transition can prove fruitful. In this respect, this paper is also an invitation for future research. It would be worthwhile to extend the inquiry to other countries like the United Kingdom, where similar debates around the discovery of North Sea oil and gas played out in the 1960s and 1970s. The role of oil companies Shell and Esso, and their in-house economists, deserves further study too. Their prior experience with oil and gas exploration, as well as their simultaneous negotiations with OPEC, could put this case in broader geographical perspective. The subsequent history of resource curse-type thinking among Dutch economists from the 1980s onward would also be an interesting research avenue, as would be the exploration of work by non-academic economists, who played, and still play, a significant role in the energy affairs of many countries and international organizations. Yesterday's experiences are undoubtedly useful in building 21st-century energy futures.

[21] We thank one of the reviewers for inviting us to think about the lessons to be drawn from our historical inquiry for the critical mineral sector.

7. Archives

National Archives (NA), The Hague.

2.06.064	Archive Sociaal-Economische Raad (SER, Council for Social-Economic Affairs)
2.06.087	Central Archive Ministry of Economic Affairs, 1944–1965
2.06.093	Archive Centraal Planbureau (CPB, Central Planning Agency)
2.06.095	Archive Ministry of Economic Affairs, Directorate-General Economic Policy
2.06.098	Archive Ministry of Economic Affairs, Directorate-General for Industrialization and Energy provision, Section Energy provision, 1946–1965),
2.06.5342	Archive Algemene Energieraad (General Energy Council)
2.19.047.01	Koninklijk Instituut van Ingenieurs (KIVI, Royal Institute of Engineers), 1847–1973

CRediT authorship contribution statement

Henk-Jan Dekker: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Antoine Missemer:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

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