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Abstract

This thesis makes two unique contributions to the International Political Economy literature. It presents the first comprehensive, empirical investigation of petrodollar accumulation and recycling spanning the period 1980-2021. It also corrects the misconception that petrodollar recycling in the 1970s and 1980s involved the extension of loans to developing countries using fractional reserve banking and argues that these loans were the extension of created credit. Petrodollars garnered significant academic attention in the 1970s and 1980s when increased oil prices led to large influxes of petrodollars to oil-exporting states and widespread deficits and stagflation in oil-importing states. The recycling of these petrodollars led to increased militarisation in oil-exporting states, as well as increased national debts in oil-importing states which precipitated the developing world's debt crisis. Between 1999 and 2021, oil prices have hit peaks higher than those reached in the 1970s and this has resulted in a similar transfer of petrodollars. This thesis uses a quantitative and qualitative methodology to explore the key role of petrodollars in the current global political economy, and to illustrate the impact they are likely to have in the future as resources deplete. Over the period 2004-2021, petrodollar accumulation averaged $1.27 trillion annually, with approximately 54.6 percent of this accumulated by the Organisation of Petroleum Exporting Countries. These petrodollars predominantly flow back into the global economy through one of two channels: economic, through increased imports and domestic expenditure; or financial, through foreign investments and the purchase of foreign exchange reserves. These recycling methods will have lasting implications as they impact on which oil-importers' deficits are financed and which are not, and which businesses/industries are funded and which are not. The significance of petrodollar accumulation and recycling is likely to further increase in the future. While advances are being made in alternative energy, oil's unique characteristics and its embeddedness in the petrochemical, agriculture, and transportation sectors make it invaluable in a petro-market civilisation which is dependent upon transnational supply chains and large-scale agriculture. This makes it likely that high oil-consumption rates will continue, as will petrodollar accumulation, until we reach depletion.

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This thesis would not have been possible without the time, guidance, support, knowledge, patience, and love of many people. I extend my thanks to my entire village as they have all contributed to the production of this thesis. However, I must make special note of the substantial contribution of those below.

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Finally, thank you to my two incredible children for being exactly themselves. I started this project with them in mind, and I hope that one day I can inspire them as much as they have inspired and motivated me.

Certification

I, Leonie Noble, declare that this thesis submitted in fulfilment of the requirements for the conferral of the degree Doctor of Philosophy, from the University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

Leonie Noble

15 March 2023

List of Abbreviations

BP	British Petroleum
CIA	Central Intelligence Agency
CPE	Critical Political Economy
EIA	Energy Information Administration
EROEI	Energy Return on Energy Invested
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GNI	Gross National Income
IEA	International Energy Agency
IMF	International Monetary Fund
IR	International Relations
IPE	International Political Economy
MIC	Military-Industrial Complex
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries
SAP	Structural Adjustment Program
SIPRI	Stockholm International Peace Research Institute
SPR	Strategic Petroleum Reserves
TIV	Trend-Indicator Value
UAE	United Arab Emirates
UK	United Kingdom
US	United States
USD	United States Dollars
WTI	West Texas Intermediate

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Chapter 1. Introduction and Theoretical Framework

1.1 Introduction

Since 2005, the price of oil[1] has been almost consistently higher than the price reached during the 1973/4 price spike.[2] It also reached levels higher than the 1979/80 spike in 2008, 2011, 2012, and 2013.[3] While the price spikes of the 1970s and their implications for the political economy gained a lot of attention and were heavily researched, this more recent trend has been largely neglected in the literature. Also neglected, is an examination of how the money accumulated in exchange for oil exports is recycled back into the global economy. In this dissertation, I contend that contemporary high prices and continued high consumption rates have resulted in a significant annual transfer of wealth from oil-importers to oil-exporters, and the means by which this wealth makes its way back into the economy will have far reaching implications for the wider global political economy. The price spikes of the 1970s and 1980s resulted in deficits, inflation, and recession. The recycling of petrodollars led to increased militarisation of oil-exporters, and greater national debts that precipitated a widespread debt crisis in the 1980s – particularly in the developing world. The recent price spikes and contemporary recycling mechanisms are likely to have similar consequences, and yet they have been under researched in the International Political Economy (IPE) literature. My thesis seeks to address this lacuna in the literature.

This chapter is divided into four sections. The first section outlines the objective and research questions addressed in this thesis. The second section outlines the theoretical framework of the thesis; providing context and the necessary theoretical foundations to follow the arguments made throughout. The third section provides an overview of the methodology. The fourth section provides an outline of the thesis's structure.

1.1a Objective

'Petrodollars' is a term coined in the 1970s to describe the income earned by oil-exporting states

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[1] Throughout this thesis, unless otherwise specified, 'oil' refers to 'crude oil'.

[2] In 1974, the price of oil reached $60.81 per barrel (in fixed 2021 USD). Over the 17 years between 2005 and 2021, the annual price of oil has only fallen below $60.81 on four occasions (see Figure 4.4 and BP 2022b).

[3] This comparison uses figures that are adjusted for inflation.

in exchange for their oil exports which are most often denominated in United States Dollars (USDs). Awareness of petrodollars and their significance to the global political economy rose to prominence during the 1970s and early 1980s when increased oil prices resulted in an unprecedented transfer of wealth from oil-importing states to oil-exporting states. The majority of the existing literature focuses on the political and economic impacts of the large petrodollar transfers that occurred in the 1970s and early 1980s. While it addresses the historical ramifications of petrodollar accumulation and recycling, the current role of petrodollars in the global political economy has been largely overlooked in recent decades. This gap in the literature begs the questions:

1. *What is the current role of petrodollars in the global political economy given historically high oil prices? and*

2. *How will petrodollars impact the global political economy if consumption rates continue, and resources continue to deplete?*

This thesis will answer these two questions.

1.1b Central Argument and Significance

Oil is the largest contributing energy source in the global political economy (BP 2020), and its combustion is fundamental to our contemporary civilisational order. Energy consumption is a necessary condition for economic growth and development and, as such, all energy sources should be of academic interest. However, its unique characteristics (as a fuel source mainly used in the transportation sector) make it especially difficult to replace with alternative energies. While progress is being made in the development of alternative and renewable energy sources, global oil consumption rates continue to increase. I argue that oil is the cornerstone of our global economic system; a system dependent on transnational supply chains, fuel-intensive production methods, and long-distance trade. As oil is indispensable to domestic and international economies, countries which do not produce sufficient oil to satisfy domestic demand must import it from countries which produce a surplus. As with all trade, this results in a transfer of wealth which can only be mitigated by the export of other goods including arms, cash crops, or other value-added goods such as machinery.

Academic interest in petrodollars was piqued during the 1970s and 1980s as the accumulation of petrodollars by oil-exporting states rapidly increased to unprecedented heights as a direct result of the oil price spikes in 1973/4 and 1979/80. The accumulation and recycling of this wealth had severe ramifications for the global economy. It stimulated recession within industrialised states and contributed to the growth of debt in the developing world, culminating in the debt crisis (Clark 2005a, 21–22; Cleveland and Bhagavatula 1980, 599–602). As the price of oil began to fall in the

1980s, academic interest in petrodollars waned, and the issue of petrodollar accumulation and recycling has remained largely absent from the IPE literature since the mid-1980s.[4]

This thesis will update the literature and return petrodollars to the central IPE debates. I argue that the global political economy remains dependent upon oil as a key energy source, and oil export rates have been steadily increasing since the 1980s. In addition, the price of oil escalated dramatically from 1999 to the early 2010s (although it has fallen notably since then). It follows, that this increased consumption coupled with increased prices resulted in a transfer of petrodollars which became concentrated in the relatively small number of countries who export vast quantities of oil. Preliminary findings suggest that the majority of these petrodollars are concentrated in the member states of the Organisation of Petroleum Exporting Countries (OPEC) who accounted for between 43.9 percent and 66.2 percent of global oil exports throughout the period spanning 1980-2021 (OPEC 2022).

Oil prices have historically been subject to volatility and severe fluctuations. However, as oil is a finite resource which is being depleted, the price of oil is likely to escalate even higher into the future unless an alternative energy source is developed and introduced with sufficient urgency to prevent disruption to energy supply.[5]

The price of oil has been low over the period 2015-2021 compared to the high prices of the 2000s to mid-2010s. However, it would be imprudent to interpret this as a signal that oil prices will continue to fall and will not play a vital role in our global political economy moving forward. Current lower prices are not a result of free, fair market mechanisms signalling that production is efficient and supply is plentiful. Rather, current low prices are largely due to market manipulation as producers vie for market domination. Several OPEC members have been manipulating the market by overproducing in an attempt to flood the market to drive out other high cost producers (Blas and Chilcote 2016; DiChristopher and Domm 2017; Raval 2015; Raval and Sheppard 2016; Rhodes 2017; Smith 2015). Simultaneously, the market is being flooded by unconventional oil developed through increasingly complex and energy intensive methods and locations (EIA 2014; Raval 2018; Rhodes 2017). This is creating a glut in the market and driving prices down, but it should not be interpreted as a long-term trend as oil – even with the addition of unconventional reserves – remains a finite resource which will become depleted. If anything, current lower prices are more sinister for the future global political economy as it encourages increased consumption at

[4] For an overview of the trends in literature on the Politics of Energy as a whole, see Hughes and Lipscy (2013).

[5] For discussions on the feasibility of such a transition see Di Muzio (2012), Fridley (2010), Heinberg (2007; 2009), Hirsch, Bezdek, and Wendling (2005), Trainer (2011), and Zehner (2012).

a time when conservation would be more prudent and removes incentives to invest in alternative energy sources.

This continued dependence and increasing prices results in an ever-larger transfer of wealth to oil-exporters, discussions of which are largely absent from the literature in International Relations (IR)/IPE. It is evident from the 1970s and 1980s that the accumulation and recycling mechanisms of petrodollars are of critical importance to the global political economy, yet the topic remains understudied in the IR/IPE literature. This thesis will update the literature by providing insight into the accumulation of petrodollars since 1980 and exploring the implications of this accumulation and the methods by which the wealth is recycled back into the global economy.

1.2 Theoretical Framework

IPE is an interdisciplinary field of study that researches and examines the increasingly transnational flows of economy and politics (Miller 2008, 2). Three main theoretical perspectives are identified in the literature as: liberalism, realism, and critical perspectives (Gilpin cited in Blyth 2009), however it is important to note that each of these theories has created the foundation for several other perspectives, for example liberalism contributed to the emergence of neo-liberalism. Within IPE, scholars are not confined to one paradigm. Instead, they often draw on several theoretical perspectives to examine phenomena within the global political economy (Hancock and Vivoda 2014, 206–8).

In this thesis, I use an eclectic theoretical approach, as no singular theoretical perspective can be used to satisfactorily explain petrodollar accumulation and recycling, as well as the likelihood that oil prices, and therefore petrodollar accumulation, are likely to escalate into the future. As a foundation, I take a critical political economy (CPE) approach. However, my analysis draws upon key theories from ecological economists, economic institutionalists, and concepts such as limits to growth and peak oil. The common threads that connect the theories and concepts utilised in this thesis are that they are wholistic, they consider historical context, they perceive the integral role of non-state actors and corporate power, and they bring ecological input to the forefront.

1.2a Critical Political Economy

Critical perspectives within IPE critically analyse the global political economy in its entirety. Marxism critiques the inequality stemming from capitalism, which occurs as power and resources become increasingly centralised (Gilpin 2001; Peterson 2009, 284). Building upon this concept is Dependency Theory and World-Systems Theory, which both identify the constitution of a world capitalist order and the systemic inequality and underdevelopment of some countries within the global capitalist system (Underhill 2000). Outside of Marxist inspired perspectives, institutionalists critique the neoclassical premise of a self-regulating market. They identify practices such as horizontal integration, which undermine competition and create monopolies of power, as well as suggesting that the main incentive of capitalists is to accumulate profits rather than seeking the most efficient modes of production (Miller 2008, 88–96). While these approaches are varied, their common theme is that they take a critical approach to the historical development and future trajectory of global capitalism. My research shares this critical approach in examining the global political economy of petrodollars. Three key frameworks within CPE will be utilised in this research: limits to growth, peak oil, and petro-market civilisation.

Five primary characteristics of critical perspectives in IPE are that they consider the historical context of the areas of inquiry, they recognise that phenomena are interconnected, they question prevalent power relations, they recognise the importance of non-state actors, and they are profoundly concerned with inequality (Bruff and Tepe 2011; Cox 1981; Di Muzio 2015; Hancock and Vivoda 2014; Tooze 2010). I utilise this approach in my research, acknowledging that the contemporary accumulation and recycling of petrodollars is not an ahistorical occurrence; it is influenced by the development of our global political economic system, the development of the international oil industry, and the political and economic climate. It is also influenced by the unequal power relations prevalent within our largely market-based economic system where oligopolies dominate, states experience uneven development, and where large non-state actors pose a challenge to the traditional power of the state (Gill 2008). In my research, I draw on the rich tapestry of CPE and then supplement this with elements of critical economic traditions – such as economic institutionalism – as well as the limits to growth thesis, and credit creation theory.

1.2b Critical Economic Traditions

While Economic Institutionalism is not technically within CPE, it has influenced CPE, and several of the concepts developed within economic institutionalism are useful for an analysis of petrodollar accumulation and recycling. Scholars from the economic institutionalist tradition critique the neoclassical premise of a self-regulating market. They identify practices such as horizontal integration, which undermine competition and create monopolies of power as well as suggesting that the main incentive of capitalists is to accumulate profits rather than to seek the most efficient modes of production (Miller 2008, 88–96). My research shares this approach in examining the global political economy of petrodollars. I draw on Veblen’s (1904/1965) notion of strategic sabotage whereby corporations sabotage industry to control production in order to maintain profitability (Nitzan and Bichler 2000). The concept of strategic sabotage used here should be understood as any act that incapacitates production in some way, it does not simply mean the wilful destruction of production. Whereas conventional economic theory posits that a primary goal of business is to maximise efficiency, I argue that (in regard to the extraction of oil) a higher priority is placed on *controlling* extraction. Sometimes this is reflected in limiting the pace of extraction to influence the price of oil, for example OPEC member states operate on production quotas whereby each state has an intended extraction goal, and this helps influence desired pricing (see Chapter 2). At other times, this is reflected in extensive and rapid production to drive the price of oil down; a practice discussed in Chapter 4. This understanding of business sabotaging industry to control production is foundational to my analysis of how oil became essential to our political economic system, and to petrodollar accumulation and recycling.

I also draw on Polanyi's (1957) argument that engagement in the market-economy is imperative in capitalist societies as most people are not self-provisioning. Polanyi identified the emergence of the market-based economy as a 'great transformation' whereby the economy became disembedded from society. He argued that the transformation into a market civilisation ultimately resulted in diminished capacity for self-sufficiency, and instead required individuals to sell their labour on the market and use their wage to purchase the necessary elements of survival. I extend upon this notion and draw on Di Muzio's (2012) identification of a *petro*-market civilisation in which the market-based society is largely powered by fossil fuel energy. This theory is supported by current energy consumption trends. Despite widespread awareness that fossil fuel consumption is unsustainable and damaging to the environment, in 2021 fossil fuels constituted 82 percent of total global consumption (BP 2022b). This perspective illustrates that not only is engagement with the market imperative, but that current practices have led to a reliance on the consumption of fossil fuel energy. The production processes themselves are often fossil-fuel intensive, and the interconnected global economy which is characterised by extreme specialisation is dependent upon fossil-fuel-powered international trade (Urry 2010, 195). In a phenomenon he named 'carbon lock-in', Unruh (2000) identified that the interconnected and interdependent nature of complex production and consumption systems on large scales introduced significant and lasting barriers to the implementation of alternative energy sources within individual sectors. These concepts inform my analysis of the oil industry, the economic system, and projected oil prices.

1.2c Limits to Growth

This thesis will also draw on the limits to growth hypothesis which argues that limitless growth on a finite planet is irreconcilable (Bardi 2011; Daly 1996; Hall and Day 2009; Meadows et al. 1972). The concept that there are natural limitations to humanity's growth has been observable since Malthus' *An Essay on the Principle of Population* (1798), which argued that the geometric increase of population and arithmetic increase in food production would result in a population which was too large for the available food supply. He proposed that large-scale die-off was likely as the (global) population would be forcibly reduced to meet what now is called the Earth's carrying capacity (not Malthus' term). This predicted outcome has thus far been avoided, in part, due to the extensive application of improved technology and fossil fuels to food production. This has effectively (but temporarily) extended the carrying capacity of the Earth (Hall and Day 2009, 230–31; Manning 2004, 37–45; Meadows et al. 1972; Pfeiffer 2006).

As highlighted above, Malthus speculated that reaching the natural carrying capacity or physical limitations of the Earth would result in large-scale death. Malthus took a particularly pessimistic approach and had callous notions regarding poverty and welfare. This general lack of concern for marginalised people and communities is at odds with CPE which, as mentioned above, is fundamentally concerned with inequality and poverty. While elements of Malthus' work are incredibly problematic, this does not mean that his foundational premise of ecological limitations is unconvincing. Food production and population growth follow different trajectories and population will no longer be able to continue increasing after the point at which those trendlines intersect. I engage with the mathematical component of this argument, which is both logical and sound. I do not engage with Mathus' ideas surrounding population reduction, nor with the questionable ethics of his proposals.

This notion of physical limitations was extended upon in the Club of Rome's report, *The Limits to Growth* (Meadows et al. 1972). The primary argument of this report was that population, food production, pollution and resource extraction were all growing exponentially, and if these trendlines continued unchecked, the Earth's limitations would be met. The authors used computer modelling to track the historical trendlines and to generate prospective futures based on potential unchecked growth across all factors, as well as futures based on potential reduced growth across different factors. Ultimately, they argued that unless the growth of several of the factors was curtailed, the Earth's limits would be hit by 2072, at which point the global population and industrial capacity would experience decline. The oil price spikes of the 1970s occurred almost immediately after the Club of Rome's report was published. The impacts of these spikes were numerous, however the sudden reduced access to a prime energy source contributed to popular interest in Meadows et al.'s (1972) argument that the Earth had natural limitations. As the global economy recovered from the 1970s oil price spikes, interest in this hypothesis faded. In fact, it was the object of heavy criticism throughout the 1980s and 1990s due to a perceived pessimistic outlook and lack of deference for the potential of technological progress to stave-off limits (Bardi 2011). From the 2000s onwards, however, the limits to growth thesis has reappeared in the IPE literature (Bardi 2011; Hall and Day 2009; Trainer 2011; Turner and Alexander 2014; Vira 2015).

Although limits to growth emerged from different intellectual origins to CPE, it is a useful approach to include when analysing depletion of non-renewable resources. With some recent exceptions, CPE inadequately addresses ecological and environmental limitations; limits to growth provides that insight. Further, the limits to growth hypothesis can be situated within critical perspectives. The theory engages with interconnectivity and acknowledges that individual concerns cannot be analysed within a vacuum as they interact with and influence other factors, as does CPE. For example, one cannot examine the escalation of industrial capacity without noting its impact on environmental degradation and resource depletion. It also promotes a historical perspective in the thesis. The application of fossil fuel energy led to unprecedented economic capacity and growth. Moreover, as pointed out by Jackson (2009), mainstream economic thought is premised upon the continuous pursuit of growth. Through their use of long-term modelling, the Club of Rome demonstrate that this is an exceptional period in human history, and not reflective of the entirety of human existence. While the data of some factors in this study only started in the 1900s due to the availability of information, their data on world population extend back to the 1650s, and their economic growth rates to the late 1700s. These data illustrate the exceptional growth which coincided with the industrial revolution and the use of coal, oil and natural gas (Meadows et al. 1972). Several critical scholars incorporate the limits to growth hypothesis into their frameworks; most notably ecological economists as they identify the failures of neoclassical economics to protect the environment (Miller 2008), or posit alternative forms of economic development which do not fetishise growth (Jackson 2009; Urry 2010; 2012; 2013; Zehner 2012). At a minimum, the concept that the current economic system – built on globalisation, resource depletion, environmental degradation, overconsumption and perpetual growth – is ecologically unsound, underpins all CPE examinations of environmental sustainability (Christoff and Eckersley 2013; Demerath 2010; Miller 2008; Pirages 2010).

The component of the limits to growth hypothesis that I primarily engage with in this thesis is the notion that there are physical constraints to infinite growth due to the finite nature of resources, specifically oil. While population growth, food production, and pollution are crucial concerns and worthy of rigorous inquiry and scrutiny, they are beyond the scope of this thesis. Furthermore, while *The Limits to Growth* (Meadows et al. 1972) used modelling techniques to suggest when the predicted crisis would occur, my thesis does not engage with their data and predicted dates. Rather, I emphasise their underlying assumptions that resource depletion is likely to constrain growth and ultimately provide a physical limitation.

The limits to growth thesis is specifically applicable to the production and consumption of oil. In 1956, the geologist and geophysicist M. King Hubbert introduced the concept of peak oil. He proposed that the production of an oil reserve would track on a symmetrical bell-shaped curve whereby the discovery of oil would be followed by an increase in production, then once half the resource had been extracted, production would reach a peak. Following this peak, production would decline and eventually return to zero. This decline would be caused by the increased costs (both in energy and financially) required for extraction as the resource became depleted (Bardi 2009, 323; Deffeyes 2001; Hubbert 1956; Pfeiffer 2006, 30). It is important to note that peak oil does not refer to how much oil exists, but rather to the rate at which oil can be extracted in a cost effective manner (Hirsch, Bezdek, and Wendling 2005, 12). The theory does not predict the complete depletion of oil; however, it is premised upon the assumption that reserves are finite. At the point where the maximum economically viable oil has been extracted (by which I mean as much as can be extracted without either expending more energy than is produced, or costing so much money that extraction is no longer cost-effective), the physical limitation of the oil supply will have been reached. Hubbert used his thesis to predict the peaking of United States (US) domestic conventional oil in 1971 with relative accuracy. Since this time, the model has been used to generate estimates of peak global production (Deffeyes 2001, 1–4).[6] While there is still debate about the date of peak global production,[7] it is clear that, as a finite resource, consumption of oil cannot continue indefinitely (Bardi 2009; Deffeyes 2001; Di Muzio 2012; Heinberg 2005; Hirsch, Bezdek, and Wendling 2005; Zehner 2012).

This thesis engages with the concept of peak oil – Hubbert's (1956) supposition that oil production would follow a bell-shaped curve and, once half of the resource was extracted, production would decrease until it was no longer financially viable or energy efficient to produce. Peak oil is a prime consideration throughout my thesis as my analysis is based upon the notion of oil scarcity and depletion. However, peak oil is a specific focus in Chapter 4 as I discuss historical oil price trends, as well as potential prices moving into the future.

I also use the concept of peak oil to analyse current lower oil prices and the danger that these pose to the political economy. Meadows et al. (1972) noted that the most common critique of limits to growth was that technological advancement could prevent the reaching of limits. This idea is supported by the classical notion of the invisible hand of the market. In theory, if a product has limited or decreasing supply, the price of the product should increase which would signal that (if demand was high) investment in alternatives would be desirable (Miller 2008, chaps. 1–2). We can apply this to peak oil. As oil (and other fossil fuels) becomes depleted, the price should rise, prompting investment and henceforth innovation in alternative energies. However, this assumes a self-regulating market where prices are determined by supply and demand. By combining Veblen's (1904/1965) notion of sabotage in relation to setting prices, and the peak oil hypothesis, we can see the dangers that price manipulation poses as supplies of oil dwindle. Sabotage of the industry leading to decreased prices can mute these 'market signals' which would purportedly prompt development of alternatives, while also potentially leading to increased consumption which would escalate the depletion process. This is explored in greater depth in Chapter 4.

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[6] See also the Association for the Study of Peak Oil, which has yearly conferences and estimates (Campbell 2008).

[7] In 2005, the US Department of Energy commissioned a report which would outline the impacts, mitigation possibility, and risk management of peak production of conventional oil; the Hirsch Report. It highlighted peak oil projections from 12 sources. While one source contended that there was no visible peak to predict, the other 11 predicted that conventional oil production would peak during the period 2006-2025 (Hirsch, Bezdek, and Wendling 2005, 19).

1.2d Credit Creation Theory

The role of banks is of crucial importance to an exploration of the political economy of petrodollars. As will be explored in Chapter 6, in the 1970s and 1980s, a significant portion of the petrodollars earned through global oil exports was deposited within commercial banks, and the ensuing response from the banks was highly consequential for the global political economy. Conventional macroeconomics, and existing petrodollar literature claim that these petrodollar deposits were recycled as bank loans. This theory presents the bank as an intermediary between savings accounts and borrowers' accounts; willing savers deposit surplus funds with a bank, and then the bank extends that money to willing borrowers as credit. This framework has been applied to the loans extended to developing states in the 1970s and 1980s, which contributed to the developing world's debt crisis (see Chapter 6 and Balaam 2014, 189; Brittan 1982; Clark 2005a; Cleveland and Bhagavatula 1980; Healey 1979; Pollack 1974; Spiro 1999). In actuality, however, these analyses are based on an inaccurate framework as bank deposits are not required for banks to make loans, and thus the flow of petrodollars into banks does not have the same ramifications as previously thought (Werner 2014a; 2014b).

The conventional fractional reserve theory suggests that banks use a fraction of all deposits to extend bank loans. Once a deposit is made in a bank, the bank is said to retain a set portion of the funds as a reserve, they are then at liberty to loan out the remainder of this money. Through financial transactions, the money from these loans is eventually deposited back into one or more banks. These new deposits are then said to be available to generate new loans (Hockett and Omarova 2017; Mankiw 2009; McLeay, Radia, and Thomas 2014; Werner 2014b). Table 1.1 illustrates the process using an initial bank deposit of $1,000, and an assumed reserve ratio of ten percent.[8] While $100 (10 percent) of the deposit is held in reserve, $900 is extended as a loan. As that loan is spent, the $900 is deposited back in a bank. Following on from this, $90 (10 percent) is kept by that bank as a reserve and the remaining $810 is extended as a loan. This process is said to continue until the final deposit is too small to be separated into a reserve and loan (Mankiw 2009). In the example in Table 1.1, the process could theoretically occur more than 65 times.

Fractional reserve banking states that through this process, the banking system as a whole generates new money through the money-multiplier model (Hockett and Omarova 2017; Mankiw 2009). It claims that all the loans generated from the deposits must be added as new money to the

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[8] Reserve ratios are said to be determined by Federal Reserve Bank. In this case, a reserve of ten percent is utilised in this table simply for ease of mathematics in this demonstration of the theory. It should also be noted that many countries such as Australia, Canada, New Zealand, the UK, and Sweden have no reserve ratio.

money supply; thus, an initial deposit of $1,000 and a reserve ratio of 10 percent could lead to an approximate additional $8,990 in the total money supply. This notion is fundamentally flawed on two counts.

Table 1.1: Fractional Reserve Banking

Initial Deposit of $1,000	
Reserve (10 percent)	**Loan**
$100	$900
$90	$810
$81	$729
$72.90	$656.10
$65.61	$590.49
$59.05	$531.44
$53.14	$478.30
$47.83	$430.47
$43.05	$387.42
$38.74	$348.68

First, the claim that this practice whereby banks increase the money supply by using deposits to retain reserves and make loans is baseless. The theory is built on a mathematical method of redistributing existing money, and it does not actually include the introduction of new money. We can use the first two transactions in Table 1.1, to demonstrate the mathematical issue with the money multiplier logic. Customer A deposits their $1,000 in a savings account. The bank holds 10 percent in reserve and extends $900 to Customer B. Customer B is at liberty to spend this money, and in this manner the money will make its way back into a bank. For example, if Customer B purchases a new car from Seller A, the money will likely end up in Seller A’s bank account. This bank is apparently then at liberty to enact the same process, holding $90 in reserve and extending $810 as a loan. However, while the theory claims that the new $900 deposit can be used to make a new loan, it also claims that Customer A still has the drawing rights to their original $1,000. Yet the money cannot be in two places at once. Either it is in Customer A’s account, Customer B’s account, *or* in Seller A’s account. Thus, fractional reserve theory is either merely a form of financial intermediation where banks engage in the distribution of money while not expanding the money supply, or the theory must be based on the extension of credit, which would mean that credit is created when loans are extended rather than loans being generated from existing deposits (see Di Muzio and Noble, 2017).

In addition to the illogical mathematics of the money multiplier model, it has been empirically demonstrated by Werner (2014b) that banks do not follow this process when extending loans. Werner was permitted by a German bank to observe the accounting procedures of extending a bank loan. His experiment demonstrated that the balance sheet operations in no way supported the fractional reserve theory, instead they reflected the credit creation theory of banking whereby loans extend a bank's balance sheet by creating an asset for the bank (a repayable loan) and a liability to the bank (a payable loan the customer can draw on) (Werner 2014b).

This thesis will use the much more defensible credit creation theory as the accurate theory of banking and the expansion of the money supply. Credit creation theory contends that all individual banks have the capability to create new money through the extension of credit by expanding their balance sheets. This occurs most often through the creation of bank loans. When a suitable applicant applies for a loan (suitability is assessed on their expected ability to make repayments along with collateral/assets owned), the bank *creates* a deposit in that person's account. They credit their account with a deposit the size of the loan. This deposit is not money that has been redistributed from funds already held by the bank. It is money which has not existed previously (Di Muzio and Noble 2017; Hockett and Omarova 2017; McLeay, Radia, and Thomas 2014; Werner 2014a; 2014b). It is created, as Werner (2014b, 16) says 'out of thin air'. The credit creation theory posits that generating new money as bank loans is a simple procedure of writing/typing the amount of credit onto a bank's balance sheet; a process which is naturally facilitated by the prevalence of digital money. In addition to credit creation being demonstrated as accurate in Werner's (2014b) empirical study, this practice of creating credit was also confirmed in an article published in the Bank of England's Quarterly Bulletin (McLeay, Radia, and Thomas 2014).

Credit creation theory complements critical perspectives within IPE as well as the limits to growth hypothesis. First, scholarly investigations of the credit creation theory call into question the power structures inherent in the banking system. While the fractional reserve theory contends that significant power over the expansion of the money supply lies with a central bank (as they are said to set the reserve ratio and therefore dictate the rate at which money can multiply), the credit creation theory recognises that the majority of the power over money expansion is held by commercial banks (Di Muzio and Noble 2017; Hockett and Omarova 2017). Explorations of the practice lead to questions regarding the legitimacy of this power and the implications for democratic control over the money supply (Di Muzio and Noble 2017). Second, scholars using the credit creation theory identify the potential for crises if limitations are not placed on the practice. While this practice allows commercial banks to create credit when they extend loans, crucially, they do not create the interest required for repayment. This means that interest repayments are an additional component of the loan which no new money is created to cover; it must be earnt from elsewhere in the economy. Therefore, with each loan, more debt is created than the ability to repay it. A monetary system built upon this practice is precariously dependent upon the continuous extension of ever more loans, as new loans are required to service the interest payments on previous loans. This provides impetus for continued economic growth, and simultaneously poses a threat to the economic system where large-scale loan defaults could result, and indeed have resulted, in crisis (Di Muzio and Noble 2017; Di Muzio and Robbins 2016). Within the limits to growth thesis, this could be viewed as a problematic practice which will eventually find limitations.

Existing petrodollar analysis posits that a portion of surplus petrodollars were deposited in Western banks, and that banks then used these surplus petrodollars to extend credit to developing countries. By applying the credit creation theory of banking, my thesis argues that petrodollar deposits did prompt the extension of loans, however not in the straightforward manner that the existing literature suggests. Fractional reserve banking would interpret the deposits and credit as a simple linear relationship; oil-exporters deposited surplus funds in a bank, the bank then loaned those funds to borrowers. Credit creation theory more accurately outlines the motivations and power relations involved. When oil-exporters deposited surplus petrodollars in banks, these funds were a liability to the bank as the bank needed to pay interest on the savings to the oil-exporters. The requirement to pay interest incentivised banks to increase their income streams. The most logical method to increase their income was to extend credit (through the creation of loans) and charge interest on those loans. In this manner, petrodollar bank deposits in the 1970s and 1980s did contribute to the extension of loans to the developing world, however not in the linear fashion previously suggested. The analysis of petrodollar bank deposits and their relationship with loans made to developing countries in the 1970s and 1980s is a fundamental innovation of my thesis, and a key contribution of my work to the literature.

1.2e Summary

As is common in critical IPE, I draw on several theories in my analysis to best explain petrodollar accumulation and recycling. I use a critical approach, focussing on sabotage and the prevalence of a market-based economy. Supplementing this, I incorporate a limits to growth approach in my analysis of the oil industry and oil prices. I also use the credit creation theory of banking when examining the recycling of petrodollars, specifically the depositing of surplus petrodollars in commercial banks and the purchase of US Treasury bonds (see Chapter 6). These main theories facilitate a critical exploration of the key issues surrounding petrodollars.

1.3 Methods

This thesis utilises both a qualitative and quantitative methodology.

The quantitative component is primarily utilised to outline the contemporary global oil industry and to calculate the wealth that is generated through global oil exports. Data on oil production, consumption, exports, and price are readily available within the public domain. Amongst others, British Petroleum (BP), the International Energy Agency (IEA), and OPEC release annual reports which include data on the contemporary oil industry, as well as regular reports speculating on the future of the oil industry. However, there are currently no data within the public domain which provide figures for the wealth generated through global oil exports. As these figures are necessary to determine the extent of petrodollar accumulation, I generate original datasets which leverage existing data on global oil exports and oil prices from 1980 until 2021. By multiplying these datasets together, I create original datasets that provide educated estimate of the quantity of petrodollars transferred annually from oil-importers to oil-exporters (See Chapter 5 for detailed methodology).

These original datasets are a fundamental innovation of my thesis and are significant for three main reasons. First, they update the literature. Petrodollars largely disappeared from the literature in the 1980s after prices decreased following the shocks of the 1970s. My thesis will bridge the lacuna and demonstrate the changes which have occurred since this time. Second, by using fixed prices rather than current prices, my datasets can be used to compare recent accumulation to historical accumulation. To the best of my knowledge, no academics have tracked the phenomenon of petrodollar accumulation over time. My datasets fill this knowledge gap and provide vital context to analyses of petrodollars and any discussion surrounding future projections. Third, while petrodollars received a lot of academic attention in the 1970s and 1980s, references to actual figures were rare and references to figures with key indicators (such as how the quantities were calculated and whether the values were adjusted for inflation) were even rarer. My datasets are reproducible and provide the necessary context to allow these figures to be reliably utilised by others. The datasets are accompanied by a thorough methodology referencing the origins of the source data, an explanation of the calculations made, and are clearly labelled in regard to where fixed figures are used, and which year the prices are pegged to. For the above three reasons, my original datasets will prove beneficial to scholars seeking a greater understanding of the global political economy and will help in developing further research on petrodollars.

The thesis primarily draws upon a qualitative methodology for Chapters 3, 4 and 6. I use a critical lens to examine the role of oil in the global political economy and existing literature on petrodollars, presenting the petrodollar accumulation and recycling of the 1970s and early 1980s as a case study. This historical evidence will be used to demonstrate the severe impacts of petrodollar recycling. I then use the experience of the past to infer the potential implications of the vast petrodollar accumulation which is continuing to occur. A key innovation of this thesis is that I will apply the credit creation theory of money to examine the historical recycling of petrodollars through Western banks. Primary sources include testimony from experts, reports from BP, the IEA, and OPEC (published annually) as well as additional statistical data on oil prices and exports.

The secondary sources consist of academic journals and books.

1.4 Structure

In order to explore my two primary research questions, this thesis is divided into six chapters which follow a logical progression to make the ultimate argument that there is a large annual transfer of petrodollars from oil-importers to oil-exporters, and there is very little information available regarding how this income is being expended even though the implications of how it is spent are likely to have significant implications for the global political economy. In addition, continued reliance on oil as a key energy source coupled with depletion is likely to see oil prices escalate into the future and increased prices will likely result in larger transfers of petrodollars.

The first chapter (this chapter) provided the necessary foundations for the ensuing arguments. It outlined the objective and significance of this thesis, including the primary research questions. It then provided an exploration of the eclectic (while still connected) theoretical framework utilised by this thesis, including an explanation of all theories and concepts that are required to understand the subsequent arguments.

In Chapter 2, I present an overview of the global industry. I begin with an examination of the development of the oil industry, commencing in the US and then expanding to other emerging international oil-producers. This examination focuses on the power dynamics inherent in the industry. Following this historical context, I use several key indicators to assess the contemporary global oil industry: global reserves, production, consumption, and exports. These indicators demonstrate that OPEC plays a crucial role in the current oil industry and is likely to continue doing so moving into the future; they are the key global oil-producers and exporters, and they possess 70.1 percent of the world's proven oil reserves. This exploration of power within the global oil industry is foundational to exploring the transfer of wealth which occurs as a result of the import/export of oil.

Throughout Chapter 3, I illustrate the relationship between the USD denomination of oil sales and the continuation of the US as the global economic hegemon. Following the breakdown of the gold standard in 1971, the denomination of most global oil sales in USDs contributed to the international incentive to hold USDs as reserve currency. To substantiate this argument, I explore the hegemonic position of the USD since the Bretton Woods Conference. I then argue that US foreign policy has been influenced by the denomination of oil sales and highlight conflicts which have (in part) been influenced by a strategic policy objective to ensure the continued hegemonic role of the USD. Following from this, I explore the interrelationship between war, oil, and the US economy. Conflicts consume oil, and if they are in or near oil-producing regions they tend to increase the price of oil. Both outcomes increase demand for the USD and thus reinforce its role as the global reserve currency. War has the added consequence of increasing arms sales which also benefit portions of the US economy; creating an incentive to perpetuate ongoing international conflict.

In Chapter 4, I argue that the price of oil is likely to escalate into the future and that the implications for the global political economy will be substantial. In order to substantiate this argument, I make four key claims. First, I track the integration of oil in the political economy, ultimately arguing that it has become vital to our contemporary civilisational order; our petro-market civilisation. Second, I examine the trendlines of oil consumption over time, and use projections from industry leaders to extrapolate that oil consumption is likely to continue over the next few decades. When this concept is coupled with the theory of peak oil, it is likely that oil prices will escalate moving into the future. Third, I examine the potential of alternative energy sources to provide a feasible replacement for oil energy ultimately arguing that the unique characteristics of oil make this unlikely in the near future. Finally, I explore the potential implications of increased oil prices for the global political economy. I outline the main political economic implications of the oil price shocks of the 1970s, as well as a short-lived crisis experienced in Europe in 2000. These examples provide insight into how increasing prices for oil could affect the economy, with one key difference: in the future, the rising price of oil is unlikely to be temporary.

In Chapter 5, I illustrate the extent of the petrodollar transfer. I outline the methodology and source data utilised and generate datasets to demonstrate the quantity of wealth accumulated globally by oil-exporting states. To provide context to this income stream, I also track it as a percentage of global gross domestic product (GDP) to illustrate the significance of its contribution to the global economy. By generating these unique datasets, my thesis provides insight into the financial role that oil imports and exports have played in the global economy since 1980 and thus begins filling the gap in the literature.

Chapter 6 explores how petrodollars are recycled back into the global economy. I begin by providing an overview of how petrodollars were recycled in the 1970s and 1980s; a topic which has been heavily researched. However, I take the unique approach of applying the credit creation theory of banking when examining how petrodollar recycling prompted the extension of loans to the developing world. I then consider the contemporary methods of petrodollar recycling and speculate on key methods within economic channels (increased imports and expenditure) and financial channels (purchasing foreign exchange reserves and foreign investment). Ultimately, I argue that greater research is needed due to the potential for significant ramifications dependent upon the prevalence of different recycling mechanisms.

Chapter 2. The Global Oil Industry

2.1 Introduction

In this chapter, I investigate the global oil industry to provide background understanding of the industry's power dynamics. This is instrumental to exploring the two main research questions of this thesis:

1. *What is the current role of petrodollars in the global political economy given historically high oil prices? and*

2. *How will petrodollars impact the global political economy if consumption rates continue, and resources continue to deplete?*

In order to explore the oil industry, the chapter is divided into two main sections. Section 2.2 examines the development of the oil industry, beginning in the US and then expanding to other oil-producing countries. The section then explores the formation of OPEC and the move towards oil nationalisation. Throughout this exploration of the industry's history, particular focus is directed to the shifting power dynamics which followed this progression. I argue that whereas the industry was controlled by companies based in the US and United Kingdom (UK) in its early decades, it is now dominated by large oil-exporting countries. Section 2.3 then examines the contemporary global oil industry using global oil statistics. It highlights the countries with large oil reserves, as well as the primary producers, major consumers, and the principal oil-exporters. Examining these components together provides insights into which countries have oil security, which countries are dependent on foreign oil, and which hold power and reap economic gains as a result of their role in the oil industry. I argue that OPEC currently dominates the industry as it holds the vast majority of oil reserves, and accounts for the majority of global oil exports. By combining the arguments that OPEC now dominates the global oil industry and that the majority of countries are dependent upon oil imports to meet their domestic demand, I extrapolate that this has implications moving into the future. The overarching trend is that global oil consumption rates are increasing (BP 2022b) however, only a small number of countries produce sufficient oil to meet their domestic demand (see Table 2.4). This means that a portion of most countries' oil energy needs are dependent upon continued access to foreign oil. As global reserves become depleted, international dependence on countries with remaining reserves is likely to increase and imbue these countries with increased economic and political power.

This chapter provides necessary context to an exploration of how petrodollars are likely to impact on the global political economy moving into the future, which will be the focus of Chapter 6.

Understanding the power dynamics of the industry – by exploring reserves, production, consumption, and export data – is fundamental to the discussion of petrodollar accumulation, especially when identifying which countries accumulate wealth, and which countries are on the other side of the transfer.

2.2 A Brief History of the Oil Industry

While oil has been used by humans for thousands of years, its exploitation only became commercially viable in the 1860s. The US was the first country to develop a thriving, if at first chaotic, oil industry and through this early development the US secured a stranglehold over the industry which lasted until the mid-1900s. I argue that the industry was developed by the US and monopolised by US and UK-based companies for approximately a century. However, from 1960 power dynamics began to shift within the industry resulting in greater power for major oil-exporting countries compared to that of the Anglo-American companies. To support this argument, I first explore the development of the oil industry, starting in the US, but also examining the emergence of key non-US companies. I outline the discovery and early extraction of non-US oil with specific emphasis on the Middle East. This section explores the formation of OPEC, and the move towards the nationalisation of much of the oil industry, highlighting the empirical evidence which demonstrates that these exporting countries now dominate the global industry.

2.2a Oil in the US

The oil industry first appeared in the Persian Gulf and Europe; however, it was innovations in extraction methods within the US which prompted mass development of the industry and led to what could be called an 'oil revolution' that propelled the international power of the US in the 20th century. For centuries, oil had been collected by siphoning the grease that seeped to the earth's surface, or by digging wells and collecting what was found for use in a variety of industries ranging from healthcare to warfare (Yergin 1991, 23–25). However, in 1859, the Pennsylvania Rock Oil Company attempted to drill for oil using the same machinery and techniques used to bore for salt. In August 1859, the company struck black gold and demonstrated that oil could be extracted by drilling into a reserve and pumping oil directly to the surface (Hall and Klitgaard 2012; Yergin 1991). This new extraction method was revolutionary in that it facilitated unprecedented extraction capacity using far less energy and allowed this wealth of fossil fuel energy to be effectively and profitably tapped. Extraction in Pennsylvania boomed and oil production increased from 450 thousand barrels in 1860, to three million barrels in 1862 (Yergin 1991, 30). This was a 567 percent increase in production over the span of two years due to improved extraction techniques which facilitated oil energy becoming commercially viable, first as fuel for light and later as a fuel for transportation (Di Muzio 2015, 105; Yergin 1991, 22–23, 63).[9]

The increased production of oil facilitated by innovative extraction techniques also created opportunity for US oil-refining companies to flourish and dominate the international oil market. In 1865, John D. Rockefeller bought out his then-partner to become the sole owner of an oil-refining company which would eventually become The Standard Oil Company; the first multinational oil corporation (Yergin 1991). Following a ruthless process of horizontal and vertical integration, Standard Oil gained control of 90 percent of the US oil business by 1880 (Hall and Klitgaard 2012; Heinberg 2005, 58; Yergin 1991). At the turn of the 20th century, two more key US companies were established; Gulf Oil formed in 1901, and Texaco in 1902. Both of these corporations would join Standard Oil in monopolising the global industry.

This early development, coupled with extensive oil reserves, facilitated the US becoming the world's largest oil producer and exporter; a position it maintained right through the first half of the 20th century. However, by around 1948, US domestic oil demand started to outstrip US production and from this point onwards, the US became a net importer of oil (Enders 1975, 625; Heinberg 2005, 65, 75; Parra 2004, 44). By 1965, the US was producing only 78 percent of the oil it consumed, meaning that it was using foreign oil to meet 22 percent of its domestic demand (BP 2022b).[10] In 1970, US production of conventional oil peaked (Deffeyes 2001, 1–4; Heinberg 2005, 75).[11] This meant that half of the conventional oil present in US territory had been extracted, and US production rates began to decline. From this time onwards, the need to import oil became systemic.

After a steady decline from 1985, US oil production sank to a low of 6.78 million barrels per day in 2008. This was followed by rapid growth reaching 16.59 million barrels per day in 2021 (BP 2022b). This increase was largely due to production of unconventional oil such as shale oil.[12]

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[9] The uses of oil, both historical and contemporary will be explored in Chapter 4.

[10] In 1965, the US produced 9.01 million barrels per day while they consumed 11.51 million barrels per day (BP 2022b).

[11] Peak oil will be explored in greater detail in Chapter 4.

[12] Unconventional oil refers to oil which is not able to be extracted by conventional methods. Conventional oil can be extracted by drilling down into a reservoir and allowing the oil to flow into the formed hole. Unconventional oil however, has formed in a way to make extraction via drilling impossible. Shale oil is oil which has formed either too close to the earth's surface, or has

While the extraction of unconventional oil led to increased production rates, the US was still unable to meet domestic demand and in 2021 they produced only 89 percent of the oil they consumed (BP 2022b).[13] In addition, it is important to note that unconventional oil is a non-renewable resource and will in turn reach its own peak and decline in production.[14]

The US was also instrumental in developing the non-US oil industry. US-based oil companies succeeded in securing access to large foreign oil reserves, particularly in the Persian Gulf, and they secured rights to production in many of these countries. This, coupled with the development of strategic alliances, specifically with Saudi Arabia (as discussed below), facilitated their integral role in international oil extraction and production for the first half of the 20th century.

2.2b The Non-US Oil Industry

Although the oil industry initially took off in the US in the 1860s, key companies emerged over the following three decades in Russia, the Netherlands, and Britain. While the US and Russia had their own national reserves which they could extract and deplete, the Dutch and British companies discovered oil within countries under their imperial influence. In this section, I outline the emergence of Russian, Dutch and British key corporations, and track their horizontal integration until the formation of the so-called ‘Seven Sisters’ - the seven US and UK-based oil companies that monopolised the global industry from 1945 (Engdahl 2004, 89). Following this, I explore the development of the oil industry within foreign territories, specifically the British in Iran and the US in Saudi Arabia.

While the oil industry was developing within the US, it was also developing in Russia. Well-drilling technology was implemented in 1872 (13 years after the US). By 1891, Russian kerosene was a key export, meeting 29 percent of global kerosene demand (Hall and Klitgaard 2012, 151). However, by 1912, its contribution to global demand had fallen to 19 percent (Engdahl 2004, 28). The Russian Revolution, which began in 1917, saw the Bolsheviks seize and nationalise the Russian oil fields; the first successful nationalisation of the industry in a large oil-exporting country (Sampson 1975, 69; Turner 1978, 29). As highlighted in Section 2.3, Russia continues to hold large oil reserves, and remains a key global oil-exporter, accounting for

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developed for an insufficient period of time, as such it forms within rock formations and must be extracted through mining rather than drilling (Rogner 2000, 140).

[13] In 2021, the US produced 16.6 million barrels per day while they consumed 18.7 million barrels per day (BP 2022b).

[14] Unconventional oil, and its inability to replace conventional oil long-term, will be discussed in greater detail in Chapter 4.

11 percent of all global crude oil exports in 2020 (OPEC, 2022).

In 1890, the Royal Dutch Petroleum Company was established in the Netherlands to develop oil in Indonesia. In 1906, it merged with the British-based Shell Transport and Trading Company to form Royal Dutch Shell (Sampson 1975, 46–48). In 1909, a new British oil company was established to develop oil in Iran: The Anglo-Persian Oil Company, which would later become BP (Sampson 1975, 52–54). Royal Dutch Shell, and BP would become two of the major oil companies within the global oil industry.

By the end of World War II, the international oil industry was dominated by seven major Anglo-American oil companies which became known as the 'Seven Sisters'. Five of these majors were US-based: Standard Oil of New Jersey (which would later become Exxon), Standard Oil of New York (which would become Mobil), Standard Oil of California (which would become Chevron), Texaco, and Gulf Oil.[15] British-based Royal Dutch Shell[16] and BP raised the number to seven (Engdahl 2004, 89; Sampson 1975, 5).

During the first few decades of the 20th century, large oil reserves were discovered in the Persian Gulf. During this period, the countries in the region were either directly or indirectly under colonial control. As such, they were not in a position to develop their own oil industries and lacked sovereign rights of ownership to the resources found within their territories (Rutledge 2005, 28). Local governments made concession agreements with the seven major oil corporations permitting the companies to drill for oil in exchange for modest royalties and loans. Given the differences in power and resources, the relationship between the leading oil companies and host countries has been described as having colonial overtones. Interestingly, the term 'concession' has often now been replaced by the terms 'Exploration and Production Agreements' to avoid the negative imperialistic connotations associated with the traditional concession agreements (Parra 2004, 1–8).

British interests attempted to get an early start on oil development in the Middle East. In 1901, William D'Arcy, a British businessman, signed a concession agreement with Shah Muzaffar al-Din, the king of Persia (later to become Iran). Under the agreement, he paid the Shah £20,000 up

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[15] Standard Oil of New Jersey, Standard Oil of New York, and Standard Oil of California were three oil companies that emerged from a forced dissolution of the colossal Standard Oil Company in 1911 (Yergin 1991, 224–25).

[16] The merger between Royal Dutch Petroleum and Shell was originally a 60:40 Dutch:British division, but by 1923 the company was under British control (Yergin 1991, 190-193).

front, a further £20,000 worth of shares, and agreed to pay him 16 percent of annual net profits.[17] In exchange he was awarded exclusive rights to explore the majority of the country for the next 60 years (Yergin 1991, 137). In 1908, the company struck oil, and in 1909 it was incorporated and went public under the name Anglo-Persian Oil Company (Yergin 1991, 145–47).

British interest in accessing oil in the Middle East became a necessity in 1911 when the British Navy began converting their coal-powered ships to oil-powered. From this point, their military dominance became heavily connected to their continued access to affordable oil (Engdahl 2004, 28; Yergin 1991, 153–74). In 1914, the British government purchased the majority ownership of the Anglo-Persian Oil Company, thus tying the company's interests to the government's interests (Engdahl 2004, 28; Sampson 1975, 51).

To protect their vital national interest in oil, Britain made several concession agreements in the Gulf giving exclusive exploration rights to British companies. This created tension as US-based companies attempted to gain concessions with local governments and the British government prevented them from doing so. In 1929, Britain relented and allowed the US to begin exploration in Bahrain, albeit while maintaining involvement by monitoring communications between the company and the Bahraini leader (Engdahl 2004, 58–75; Yergin 1991, 194, 282–83). This marked the key entrance of US oil corporations into the Persian Gulf.

One of the most crucial agreements made during the early 1900s between an oil company and a host country government was the 1933 concession agreement between the US company Standard Oil and Saudi Arabia (Rutledge 2005, 29; Yergin 1991, 289–300). This agreement proved to be highly beneficial to the US moving forward, as Saudi Arabia held extensive oil reserves. Saudi Arabia is still an oil giant, and currently holds the world's second largest proven oil reserves.[18] In addition, it continues to be the world's largest exporter of oil (BP 2022b; OPEC 2022). This concession marked the commencement of a special relationship between Saudi Arabia and the US.

In 1945, the connection between the US and Saudi oil was further strengthened (Bronson 2006, 42). A secret meeting between President Roosevelt and King Ibn Saud was held on the Suez Canal. Although there is no official transcript of this meeting, it is widely believed that Ibn Saud agreed to secure oil exports for the US, and to denominate Saudi oil in USDs in exchange for US protection of his regime and access to military hardware (Clark 2005a, 45; Heinberg 2005, 76;

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[17] Nominal pounds are used here (rather than USDs) to reflect the accurate terms of this concession agreement.

[18] The country with the largest proven oil reserves is Venezuela (BP 2022).

Rutledge 2005, 30–31).[19] The alliance initiated by both of these agreements placed the US in a position of strong influence over the international oil industry as will be discussed in Chapter 3.

2.2c OPEC, Nationalisation, and Shifting Power

In 1960, five major oil-producing countries (Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela) sought to gain greater control over oil pricing mechanisms by forming OPEC (Gorelick 2010, 23). The organisation was later joined by other key producers and now comprises the original five with the addition of Algeria, Angola, Equatorial Guinea, Gabon, Libya, Nigeria, Republic of Congo, and the United Arab Emirates (UAE). As outlined in Section 2.2b, the development of oil production in the Gulf was largely organised by Anglo-American companies. While this was primarily due to a shortfall in their own domestic oil production capacity, the concession agreements which were made and the royalties paid to the host countries can be interpreted as insufficient, exploitative, and imperialistic. The formation of OPEC and the move to nationalise oil industries illustrates the shifting power dynamics within the global oil industry, from Anglo-American oil companies to large oil-producing countries.

The terms of the initial agreement between Saudi Arabia and Standard Oil in 1933 provides an example of the inequality present during the industry's establishment in the Gulf. The original agreement provided the Saudi king with gold to the value of £35,000. Of this gold, £5,000 was an advancement of the first year's royalties, and the remaining £30,000 was a loan. The concession also made provisions for future loans of up to £120,000 dependent upon the length of exploration and the discovery of oil. Royalties were to be an annual sum of £5,000, in addition to four shillings paid per tonne of oil extracted. Importantly, these royalties were to contribute to the repayment of the aforementioned loans (US Federal Trade Commission 1952, 114; Yergin 1991, 291).[20] So in reality, the king was given one year's advance of royalties totalling £5,000 and a loan with a built-in repayment plan. This punitive agreement was not representative of the oil reserves Saudi Arabia would prove to have. It demonstrates the imbalance of power during the negotiations where the US company held greater power, and Saudi Arabia had few other options. In the early 1930s, Saudi Arabia was experiencing financial difficulty and King Ibn Saud needed funds. He

[19] The decision to denominate Saudi oil in USDs secured the US's role in the international oil industry even after much OPEC oil was nationalised and the US-based major companies had relinquished their domination of the industry. The role of the USD in the global oil industry will be explored in Chapter 3.

[20] While USD are used consistently throughout this thesis, nominal British pounds are used in reference to this agreement as it reflects the currency of the initial agreement and how this agreement is referenced throughout the IPE literature.

was thus more interested in an immediate payment, rather than an agreement which would provide long term income. In addition, few other oil corporations were interested in bidding for exploration rights in Saudi Arabia (Yergin 1991, 286–91). The result of these two factors was a concession agreement which was highly beneficial to Standard Oil and can be interpreted as exploitative of Saudi Arabian resources.

While the above example focuses on the initial agreement between Standard Oil and Saudi Arabia, it is representative of other concession agreements between governments in the Gulf and Anglo-American oil companies. Oil companies had the necessary technical knowledge and capital to develop oil reserves, while the host countries did not. In addition, the oligopolistic nature of the oil industry meant that there was limited competition between companies bidding for exploration and extraction rights. These two factors combined resulted in a situation where the majority of developing countries with oil reserves were primed to accept whatever terms the oil corporations set (Vernon 1993, 75). This illustrates the colonial overtones of early Gulf production and the power of multinational corporations in extractive industries dealing with developing countries.

During the post-WWII period, nationalism emerged quickly in the Middle Eastern states, in part, due to the desire of oil-exporting countries to gain control over their oil production (Vitalis 2007, 14). In 1951, Iran was the first state in the region to attempt to nationalise their oil resources. In retaliation, Britain led an embargo against Iran (Clark 2005a, 124–25; Engdahl 2004, 95; Kobrin 1985; Vitalis 2007, 14). In 1954, after a coup, oil production resumed in Iran, and while the oil industry technically remained nationalised, it continued to be managed and operated by Anglo-American companies (Parra 2004, 22).

After the formation of OPEC in 1960, increased government participation and nationalisation of oil industries was more successful. The Tehran and Tripoli Agreements of 1971 sparked the transition of power from Anglo-American oil companies to the countries whose territory housed the oil. These agreements were the outcome of unified OPEC negotiations against the major oil companies. They used their collective bargaining power to negotiate increased oil prices, and to increase taxes on oil companies to 55 percent (Parra 2004). Ultimately, the power realised from this unified action escalated into a series of nationalisations. Between 1970 and 1973, Algeria, Libya and Iraq all nationalised their oil industries (Parra 2004, 150; Vitalis 2007, 14). Other OPEC members signed ‘participation’ agreements whereby governments would nationalise part of their oil industries and would purchase a portion of the shares from the oil companies at inflation-adjusted net book value. Abu Dhabi, Kuwait, Saudi Arabia, and Qatar elected for participation by taking ownership of 25 percent of their oil industries in 1973, with increases planned in increments (Parra 2004, 158).

The shifting power relations between oil corporations and the governments of oil-producing countries can be accounted for by three key contributing factors. First, by the mid-20th century, oil-producing countries had increased ability to produce their own oil. Whereas technological knowledge was previously exclusive to oil corporations, by the 1950s the necessary technology was no longer restricted under patents, and exploration and drilling specialists could be subcontracted (Kobrin 1985, 18; Vernon 1993, 75). This access to the means of production made nationalisation feasible. Second, as the industry developed, host countries established a more accurate estimate of the value of their oil resources, and their desired outcome shifted from quick revenue towards strategic control (Kobrin 1985, 18; Ozawa 1993, 113–14). Third, the collective strength afforded by forming OPEC facilitated much greater bargaining power. While some earlier attempts at nationalising had been thwarted, once the major oil-producing nations had formed a cooperative bloc, their economic and political power, and therefore their ability to nationalise, were greatly increased. These three factors – increased access to technology and knowledge, greater recognition of their oil reserves' value, and collective bargaining power – resulted in the increased power of oil-producing countries, and a corresponding decreased power of international oil companies.

Since the 1960s, there has been such a significant shift in power between the Anglo-American oil companies and oil-producing countries that Hoyos (2007) highlighted a list of 'new Seven Sisters'. These were companies which were primarily state-owned by non-Organisation for Economic Co-operation and Development (OECD) countries; Saudi Aramco,[21] NIOC (Iran), PDVSA (Venezuela), CNPC (China), Gazprom (Russia), Petrobras (Brazil), and Petronas (Malaysia). As a collective, in 2007 these 'new Seven Sisters' controlled over 33 percent of global oil and gas reserves, and nearly 33 percent of global oil and gas production. This is vastly more than the original 'Seven Sisters' who, as of 2007, owned only three percent of global reserves and controlled ten percent of production. This illustrates how countries with high oil reserves increased control over their resources after 1960.

After the formation of OPEC, oil reserves became a powerful bargaining tool. The states of OPEC hold and export the majority of the world's oil (BP 2022b), and an alliance between these states presented a daunting counterbalance to the power of industrialised nations. All modern states require oil to function and the majority of the world's oil comes from OPEC member states (Hall and Klitgaard 2012; Stobaugh and Yergin 1979). This makes industrialised countries economically vulnerable to OPEC.

In 1973/4, the price of OPEC oil dramatically increased. The cause of this price spike is debated in

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[21] Saudi Aramco has since been publicly listed. In 2019, it launched the world's largest Initial Public Offering making 1.5 percent of its valuation available to investors. By its second day on the market, Saudi Aramco was valued at $2 trillion (USD) (Klebnikov 2019).

the literature, and the potential motivating factors are discussed in Chapter 3. The price spike of 1973/4 combined with a second spike in 1979/80 saw non-oil-exporting states (including developing and industrialised states) face severe balance-of-payment deficits and recession (Cleveland and Bhagavatula 1980, 599; Engdahl 2004, 140; Hall and Klitgaard 2012, 328–34). The manipulation of oil prices or levels of production based on political motivations has become known as the 'oil weapon'. Although the beneficiaries of the 1970s' price spikes are debated, OPEC successfully demonstrated the power of the 'oil weapon' and the strength of an oil-exporters' alliance (albeit as prices declined in the 1980s some of this strength dissipated).

In direct response to the formation of OPEC and their use of the 'oil weapon', a group of industrialised nations formed the IEA in 1974 to act as a counterbalance to OPEC (Di Muzio 2015, 2).[22] Industrialised states recognised the power of the 'oil weapon' and the need for cooperation to counteract this increased economic and political power. The strength demonstrated in the international sphere by an allied handful of exporters presented a stark contrast to the power relations present during the initial development of the international oil industry; a marked power shift between the original Seven Sisters and the governments of OPEC (Parra 2004, 146).

2.2d Summary

This section has explored the development of the oil industry. It tracked the emergence of the oil industry in the US with the implementation of innovative technologies dramatically increasing the scale of production through to its development globally. By following this progression, it is evident that the oil industry was once dominated by seven powerful Anglo-American companies. However, with the formation of OPEC in 1960 and the ensuing trend of nationalising oil industries, major oil-exporting countries have secured a significantly more powerful role within the global oil industry.

2.3 The Contemporary Oil Industry

In this section, I demonstrate that OPEC member states dominate the contemporary oil industry by using several key indicators: oil reserves, oil production, oil consumption, and oil exports. First, oil reserve data can be used to determine the location and quantities of existing oil. These figures demonstrate where oil reserves are, and how much oil there is to produce. Second, oil production

[22] The IEA's initial mandate was to provide an alliance for cooperation in the event of future oil supply disruptions. Since its conception, its purpose has expanded to address aspects of all energy sources including renewables, coal, gas, and oil. It is motivated to 'enhance the reliability, affordability and sustainability of energy' (IEA n.d.).

figures illustrate which countries produce oil and the quantities that they currently produce. When examined together, reserves and production data provide insights into the potential longevity of oil production in countries or regions, as well as indicating the potential scope for future production. Third, oil consumption statistics demonstrate how much oil countries consume and, when this is used in conjunction with oil production figures, can provide insights into oil security or dependence on oil imports. Finally, oil export data provide information on how much oil is being exported and where the exports originate from and, therefore, which countries may have power through their control of oil movement. In order to understand the contemporary global industry, all four elements must be examined in conjunction with each other. Through analysing each component, I demonstrate that OPEC dominates the global oil industry. OPEC member states hold the majority of the world's oil reserves within their territories (70.1 percent in 2020). They produce large quantities of oil (collectively, OPEC produced 35 percent of the global total in 2020), and, importantly, they consume comparatively little of what they produce. In addition, they have been responsible for an average of 53.5 percent of total global oil exports annually between 1980 and 2020 (OPEC 2022, tbl. 5.2).[23]

2.3a Oil Reserves

Obtaining accurate data on oil reserves can prove problematic. Historically, oil-producing states have been known to manipulate their oil field data to portray inflated figures. Manipulation of oil discoveries and oil reserve data can occur for several reasons. First, larger reserves can attract greater investment, which naturally creates motivation to inflate figures for financial gain. Second, larger reserves can be used to justify higher production rates. This occurred extensively during the OPEC quota wars in the second half of the 1980s. OPEC members decided in the early 1980s to produce under a system whereby each state would have individual production quotas based on their oil reserves. Between 1986 and 1990, OPEC members increased their reported oil reserves by 300 billion barrels because higher reserves justified higher production rates (Clark 2005a, 80–81).

There are also discrepancies between sources on what resources should be included in reserves data. For example, in 2020, the two most reputable sources recorded vastly disparate reserves for the US and Canada. While the BP *Statistical Review* reported 68,757 million barrels and 168,088 million barrels respectively, the OPEC *Annual Statistical Bulletin* reported 35,835 million barrels and 5,005 million barrels respectively. The discrepancy in data for the US is significant; OPEC records them as having just over half the reserves that BP records them as having.

[23] Over these 42 years their annual contribution has fluctuated between 43.9 percent and 66.2 percent of the global total (OPEC 2022, tbl. 5.2).

However, more significantly, BP records Canada as having more than an incredible 33 times the reserves that OPEC records them having. This can largely be attributed to the inclusion or exclusion of unconventional oil. OPEC notes that their Canada figures do not include tar sands, and by looking at BP data over the last few decades, it can be inferred that the discrepancy between data for the US also can be accounted for by the in/exclusion of unconventional oil reserves.

In addition to intentional misreporting and data discrepancies, several oil-producing countries classify their oil reserve data as state secrets, and divulging this information carries a prison sentence (Clark 2005a, 80–81; Pfeiffer 2006, 32; Tsoskounoglou, Ayerides, and Tritopoulou 2008, 3081). This can make oil field data near impossible to verify.

Table 2.1: Proven Oil Reserves by Country at end of 2020 (OPEC members marked with *)

	Country	Million Barrels	Percentage of Global Total
1	Venezuela*	303,806	17.5
2	Saudi Arabia*	297,527	17.2
3	Canada	168,088	9.7
4	Iran*	157,800	9.1
5	Iraq*	145,019	8.4
6	Russia	107,804	6.2
7	Kuwait*	101,500	5.9
8	UAE*	97,800	5.6
9	US	68,757	4.0
10	Libya*	48,363	2.8
11	Nigeria*	36,890	2.1
12	Kazakhstan	30,000	1.7
13	China	25,963	1.5
14	Qatar	25,244	1.5
15	Algeria*	12,200	0.7
16	Brazil	11,925	0.7
17	Norway	7,902	0.5
18	Angola*	7,783	0.4
19	Azerbaijan	7,000	0.4
20	Mexico	6,066	0.4
	OPEC Members	**1,214,670**	**70.1**

Note: Figures for OPEC include all 13 member states (including Equatorial Guinea, Gabon, and Republic of Congo which do not appear in the global top 20).

Source: BP, Statistical Review of World Energy 2022 Workbook, 2022.

While it is important to keep these challenges in mind, this research uses reserves data from the most reliable available source which is the BP *Statistical Review of World Energy* (2022). The extraction and production of unconventional oil may be more energy (and financially) intensive, however its discovery and role in prolonging the use of oil as a prime energy source has been a vital development, and the inclusion of unconventional reserves is crucial to an analysis of the contemporary oil industry.

Table 2.1 illustrates the 20 countries with the largest oil reserves at the end of 2020. These data indicate that oil reserves are highly concentrated. While most countries in the world contain some oil, only a small number contain large quantities. As a collective, the top 20 countries contain almost all global oil (96.3 percent), however the top ten countries possess 86.4 percent. The top four countries (Venezuela, Saudi Arabia, Canada, and Iran respectively) possess 53.5 percent of total global reserves, meaning that over half of all global oil is contained within the territory of just four countries. Within this top four, the reserves are even more concentrated, with Venezuela containing nearly twice as much oil as Iran.

If we look at OPEC as a collective, rather than focussing on individual countries, it is evident that they possess the vast majority of global oil reserves. At the end of 2020, 70.1 percent of the total global proven reserves were concentrated in these 13 countries. Three OPEC states which did not fall into the top 20 countries by oil reserves were Republic of Congo, Gabon, and Equatorial Guinea which were numbers 27, 35, and 39 respectively. The two non-OPEC countries with substantial oil reserves were Canada and Russia. They possessed 9.7 and 6.2 percent of total global reserves respectively.

2.3b Oil Production

Approximately 100 countries produce oil (EIA 2020b). However, the majority produce only small quantities and do not significantly contribute to total global production. The top 20 oil-producing countries in 2020 are displayed in Table 2.2.

As can be seen in these data, the US, Saudi Arabia, and Russia are the largest producers by a significant margin, collectively accounting for 43.1 percent of global oil production; and each producing more than double the output of Canada, the fourth largest producer. Again, if we view OPEC as a collective rather than looking at individual countries, we see the significant role that OPEC plays. In 2020, OPEC was responsible for 34.8 percent of total global production.[24] This

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[24] In 2020, five OPEC members were not included in the top 20 oil producers. Venezuela produced 0.7 percent of the global total, Libya produced 0.5 percent, Republic of Congo produced 0.3 percent, Gabon produced 0.2 percent, and Equatorial Guinea produced 0.2 percent (BP 2022b).

means that an allied group of 13 countries was responsible for 34.8 percent of global oil production while the remaining 65.2 percent was produced by approximately 87 other countries. This, naturally, gave OPEC significant control over the industry in 2020 as any collective decision to decrease or increase production would have significant impacts on the global supply.

Table 2.2: Top 20 Oil-Producing Countries in 2020 (OPEC members marked with *)

	Country	Thousand Barrels Per Day	Percentage of Global Total
1	US	16,458	18.6
2	Saudi Arabia*	11,039	12.5
3	Russian Federation	10,667	12.1
4	Canada	5,130	5.8
5	Iraq*	4,114	4.6
6	China	3,901	4.4
7	UAE*	3,693	4.2
8	Iran*	3,084	3.5
9	Brazil	3,030	3.4
10	Kuwait*	2,695	3.0
11	Norway	2,003	2.3
12	Mexico	1,912	2.2
13	Nigeria*	1,828	2.1
14	Kazakhstan	1,806	2.0
15	Qatar	1,714	1.9
16	Algeria*	1,330	1.5
17	Angola*	1,318	1.5
18	UK	1,049	1.2
19	Oman	951	1.1
20	Colombia	781	0.9
	OPEC Members	**30,839**	**34.8**

Note: Figures for OPEC include all 13 member states (including Equatorial Guinea, Gabon, Libya, Republic of Congo, and Venezuela which do not appear in the global top 20).

Source: BP, Statistical Review of World Energy 2022 Workbook, 2022.

By examining Tables 2.1 and 2.2 together, it can be seen that production rates do not necessarily equate with proven oil reserves. The production rates and reserve data of the US, Venezuela, and OPEC are explored below to demonstrate the value of viewing this information in tandem to understand the significance of each dataset.

In 2020, the US had proven reserves of 68,757 million barrels, and in the same year produced 16.46 million barrels per day. This equates to a total of 6,024.4 million barrels of oil produced for that year.[25] As a percentage, in 2020, the US extracted nearly nine percent of its total proven reserves. Many factors contribute to oil production rates. External factors such as government policy, investment, demand, and environmental factors can either increase or decrease production. In addition, following Hubbert's Curve, extraction of any given reserve becomes more energy intensive and financially expensive as the reserve depletes, and this naturally slows production rates (for an exploration of peak oil and Hubbert's Curve see Section 1.2c). However, assuming that the 2020 rate of production is maintained in the US, and assuming that no significant new reserves are discovered, the US will exhaust its currently proven oil reserves in less than 12 years. This indicates that, although the US has supplemented their domestic production with oil imports since 1948, unless the US is able to significantly decrease their oil consumption, their dependence on foreign oil is likely to increase dramatically moving into the future as their current production rates cannot be maintained. This is likely to have significant implications within the global political economy as the US (along with other large oil-consuming countries) will need to rely ever more heavily on oil-exporters including OPEC member states. The implications are both political and economic; political in that increased dependence on OPEC oil will likely increase the power of the potential 'oil weapon' whereby OPEC could limit or cut off exports to achieve political outcomes; and economic in that increased need to import oil will lead to increased transfers of funds to oil-exporting countries. The transfer of petrodollars from oil-importers to oil-exporters will be explored in detail in Chapter 5.

The US production and reserve data can be compared to that of Venezuela which, in contrast, appears to be producing a relatively small amount of oil compared to its proven reserves. In 2020, Venezuela possessed the largest percentage of global oil reserves (17.5 percent), however, it contributed only 0.7 percent of total global production, and was the 24th largest oil producer. To put this in the same context as the US example, in 2020 Venezuela had 303,806 million barrels of proven oil reserves, and in the same year it produced 0.64 million barrels per day. This equates to 234.2 million barrels produced by Venezuela in 2020. Assuming that the rate of production is maintained (again, unlikely given the bell curve production of oil fields, and external factors which impact on production), Venezuela could potentially maintain this production rate for 1,297 years. This indicates that, in contrast to the US which was the largest oil producer in 2020 and was likely producing at an unsustainable rate, Venezuela has the scope for extended production or increased rates of future production. Moving into the future this implies that while other states' oil reserves may become depleted, Venezuela will have the potential to continue production. If global oil demand remains steady, or follows the current trend and continues to

[25] To calculate the annual production rate, the daily production figure has been multiplied by 366 as 2020 was a leap year.

increase, Venezuela (along with other states with remaining reserves) may experience increased geopolitical power through their role in the supply of oil.

As a collective, OPEC possesses the vast majority of global proven oil reserves. In 2020, their reserves constituted 70.1 percent of total global reserves. Using the same equation applied to the data on the US and Venezuela, as a collective OPEC should have the capacity to maintain their 2020 rate of production for nearly 108 years. Interpretation of this figure is dependent upon one's perspectives on the likelihood of human ingenuity leading to the development and implementation of alternative replacement fuels. However, another vital factor to consider is that as other countries exhaust their oil supplies and slow their production as a result, OPEC states may be called upon to produce greater quantities to relieve the shortfall and this may speed up the rate of OPEC oil depletion.

These three examples – the US, Venezuela, and OPEC – demonstrate the necessity of considering proven oil reserves when analysing production rates. Examining production rates independently can provide a snapshot of which countries are producing large or small quantities, but without also looking at proven oil reserves there is no indication of potential production longevity. Examining the two datasets in conjunction provides a more holistic understanding of future production capabilities.

2.3c Oil Consumption

Table 2.3 highlights the top 20 oil-consuming countries in 2020. The US is the world's largest oil-consuming country, with consumption rates of 17.2 million barrels of oil per day in 2020, making up 19.4 percent of total global oil consumption for that year. China was also a significant consumer at 14.4 million barrels per day, accounting for 16.2 percent of total consumption. The top six countries accounted for 52.2 percent of total global consumption. In other words, these six countries: the US, China, India, Saudi Arabia, Japan, and Russia consumed more oil than the combined total consumed by the rest of the world. This demonstrates that there is a great global disparity in oil consumption. This disparity is present even within the top consumers, with the US and China each consuming more than three times the amount of any other global consumer. In fact, the largest consumer (the US) consumes just under five times as much oil daily as the fourth largest consumer (Saudi Arabia).

Table 2.3: Top 20 Oil-Consuming Countries in 2020

	Country	Thousand Barrels Per Day	Percentage of Global Total
1	US	17,183	19.4
2	China	14,408	16.2
3	India	4,701	5.3
4	Saudi Arabia	3,552	4.0
5	Japan	3,269	3.7
6	Russian Federation	3,210	3.6
7	South Korea	2,630	3.0
8	Canada	2,191	2.5
9	Brazil	2,134	2.4
10	Germany	2,049	2.3
11	Iran	1,673	1.9
12	Indonesia	1,398	1.6
13	Singapore	1,343	1.5
14	Mexico	1,313	1.5
15	France	1,307	1.5
16	Thailand	1,214	1.4
17	UK	1,172	1.3
18	Spain	1,056	1.2
19	Italy	1,039	1.2
20	Taiwan	946	1.1

Source: BP, Statistical Review of World Energy 2022 Workbook, 2022.

When consumption rates are examined in conjunction with production rates, we can glean more information about oil security. For the purposes of this thesis, I define oil security as a country's ability to access sufficient oil to meet domestic consumption. A country which produces as much, or more, oil than they require for consumption has high oil security as they have the potential to be self-sufficient in regard to their oil needs. In contrast, a country which produces little or no oil, but requires more for their consumption has low oil security as they are dependent on foreign oil to meet their domestic demand.[26] While depending on oil imports is not inherently negative, it does

[26] It is important to note that not all domestic production would be consumed domestically. For example, while the US does not produce sufficient oil to meet their domestic demand, they still export oil (see Table 2.5). Production and consumption data are used for this analysis instead of consumption and import data because production and consumption data give a stronger indication of a state's capability to meet domestic demand. States may choose to trade oil for multiple reasons other than necessity (maintaining international relations, seeking economic gain, meeting

leave a country vulnerable to external factors which could affect its ability to purchase foreign oil. These factors include (but are not limited to): foreign policy decisions within oil-exporting states; political disruptions within or around oil-exporting states; and fluctuations of production rates, prices, and exchange rates.

Table 2.4 provides data on the top 20 oil-producing countries and compares that dataset to the same countries' oil consumption rates. Out of the top 20 oil-producing countries in 2020, 17 countries produced more oil than they consumed.[27] The difference between production and consumption ranged from Brazil who produced 1.4 times more oil than it consumed, to Norway who produced nearly ten times more oil than it consumed. Other large producers with comparatively low consumption rates were Iraq who produced 6.5 times as much oil as it consumed, Kuwait at 6.1 times more, Kazakhstan who produced six times more, and Qatar who produced 5.8 times more.

In a discussion on oil security, it is vital to also examine OPEC. In 2020, OPEC's oil production was 30.84 million barrels per day. However, ascertaining OPEC's consumption rates requires some estimations. Only seven OPEC member states consume sufficient oil to be included in the data in BP's *Statistical Review* (Algeria, Iran, Iraq, Kuwait, Saudi Arabia, UAE, and Venezuela). The remaining six member states (Angola, Equatorial Guinea, Gabon, Libya, Nigeria, and Republic of Congo) consume little and are instead included in collective regional figures with other low-consuming states. If we were to overestimate and include all figures for unspecified regional Northern Africa, West Africa, Central Africa, and Southern Africa as well as the OPEC members for which there are available data, we could assume that OPEC consumed a maximum of 10.18 million barrels per day. This means that they consumed no more than 33 percent of the oil they produced. This indicates a significant degree of oil security as they produced surplus oil, rather than simply meeting domestic consumption needs.

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the processing requirements of crude oil, amongst others) and thus import data do not necessarily indicate dependence on foreign oil. However, comparing production and consumption rates provides insight into a state's real capability to extract the oil required to meet domestic consumption needs if there were disruptions to the international oil market, therefore providing a more accurate picture of oil security.

[27] The consumption rates for Nigeria and Angola were omitted from the BP *Statistical Review* due to their low quantity. For this reason, we can assume that their production was greater than their consumption.

Table 2.4: Top 20 Oil-Producing Countries and their Oil Consumption Rates in 2020 (OPEC members marked with *)

	Country	Production (thousand barrels/day)	Consumption (thousand barrels/day)	Surplus / Deficit (thousand barrels/day)	Production as percentage of Consumption
1	US	16,458	17,183	- 726	95.8
2	Saudi Arabia*	11,039	3,552	7,487	310.8
3	Russian Federation	10,667	3,210	7,457	332.3
4	Canada	5,130	2,191	2,939	234.1
5	Iraq*	4,114	629	3,485	653.9
6	China	3,901	14,408	- 10,507	27.1
7	UAE*	3,693	855	2,839	432.2
8	Iran*	3,084	1,673	1,411	184.4
9	Brazil	3,030	2,134	897	142.0
10	Kuwait*	2,695	441	2,254	611.0
11	Norway	2,003	204	1,799	982.5
12	Mexico	1,912	1,313	599	145.6
13	Nigeria*	1,828	-	-	-
14	Kazakhstan	1,806	302	1,504	597.8
15	Qatar	1,714	296	1,418	579.1
16	Algeria*	1,330	385	945	345.6
17	Angola*	1,318	-	-	-
18	UK	1,049	1,172	- 123	89.5
19	Oman	951	190	761	499.9
20	Colombia	781	277	504	281.9

Note: The consumption data for Nigeria and Angola is unavailable through BP as their consumption was minimal and their data were included within regional figures. As such, the calculations of surplus/deficit for these countries are omitted from this analysis, however it can be assumed that their production significantly outweighs their consumption.

Source: BP, Statistical Review of World Energy 2022 Workbook, 2022; Calculations are author's own.

As is illustrated in Table 2.4, three of the top 20 oil-producing countries consumed more oil than they produced in 2020 (indicated in red). As per Section 2.3b, the US was the largest oil-producing country in 2020, producing 16.5 million barrels of oil per day. However, in the same year they consumed 17.2 million barrels of oil per day. Thus, despite making a significant contribution to global production rates, they were dependent upon imported oil to meet their consumption needs. China and the UK were in similar positions, producing only 27.1 percent and 89.5 percent of the oil they consumed respectively.

Two key oil consumers – India and Japan – are conspicuously absent from Table 2.4 as they are not key oil producers, however due to their high oil consumption rates they require analysis through this framework. India consumed approximately 4.7 million barrels of oil per day and produced only 0.77 million barrels per day. This equates to a daily 3.9 million barrel shortfall, meaning they produced only 16.4 percent of the oil required for domestic consumption in 2020, leaving them reliant on foreign oil for 83.6 percent of their oil demands. Japan's oil production is minimal and was not included in the 2020 BP *Statistical Review*, however, by overestimating and using BP's data on unspecified regional Asia Pacific we can infer that they produced an absolute maximum of 0.2 million barrels per day. In the same year, they consumed 3.27 million barrels of oil per day (BP 2022b). This suggests that in 2020, at least 93.9 percent of the oil they consumed was produced internationally.

When consumption rates are examined in conjunction with production rates, it is clear that high production rates do not necessarily signify oil security. The top three oil consumers in 2020 were the US, China, and India. All three of these states produced less than they consumed, leaving them dependent upon foreign oil to meet domestic demand. Collectively, these three states were responsible for 40.9 percent of global consumption in 2020, and yet in the same year were responsible for approximately 23.9 percent of total production. This shortfall indicates high degrees of oil insecurity.

2.3d Oil Exports

Table 2.5 portrays the top 20 oil-exporting countries of 2020. As a collective, these 20 countries were responsible for 90.3 percent of total global oil exports. However, there is again great disparity within this top 20.

Saudi Arabia was by far the largest exporter, with exports totalling 6.7 million barrels per day or 15.8 percent of total global oil exports. In 2020, Saudi Arabia exported 44 percent more oil than Russia and 94 percent more than Iraq (the second and third largest exporters respectively). Russia exported 4.6 million barrels per day, which equates to 11 percent of the global total, and Iraq 8.2 percent. Canada, and the US both exported similar quantities, ranging from 3.1 to 3.2 million barrels per day. Collectively, these top five countries were responsible for approximately half of all global oil exports that year.

OPEC member states accounted for the majority of global oil exports in 2020. Iran, Libya, Republic of Congo, Gabon, and Equatorial Guinea did not make the list of top 20 oil exporters, but are numbers 21, 23, 24, 27, and 30 respectively. OPEC's total contribution was approximately 19.7 million barrels per day or 46.9 percent of all global oil exports. This significant contribution is historically typical; over the 42 years between 1980 and 2020, OPEC has been responsible for between 43.9 percent and 66.2 percent of global oil exports (OPEC 2022, tbl. 5.2). If this contribution to global oil exports is considered in conjunction with the potential for OPEC to unilaterally use the aforementioned 'oil weapon' to restrict oil supply, OPEC's vital role and power within the international oil industry is glaringly apparent. Utilisation of OPEC's 'oil weapon' in 1973/4 had dire consequences for the global economy with virtually all non-oil-exporting countries experiencing recession and debt. OPEC's domination of global oil exports provides power within the oil industry, and power within the global political economy as a whole.

Table 2.5: Top 20 Oil-Exporting Countries in 2020 (OPEC members marked with *)

	Country	Thousand Barrels per Day	Percentage of global total
1	Saudi Arabia*	6,659	15.8
2	Russia	4,617	11.0
3	Iraq*	3,428	8.2
4	US	3,206	7.6
5	Canada	3,146	7.5
6	UAE*	2,418	5.8
7	Nigeria*	1,879	4.5
8	Kuwait*	1,826	4.3
9	Norway	1,502	3.6
10	Kazakhstan	1,417	3.4
11	Brazil	1,401	3.3
12	Angola*	1,220	2.9
13	Mexico	1,199	2.9
14	Oman	860	2.0
15	UK	726	1.7
16	Colombia	541	1.3
17	Azerbaijan	500	1.2
18	Venezuela*	487	1.2
19	Qatar	464	1.1
20	Algeria*	439	1.0
	OPEC	**19,701**	**46.9**

Note: Figures for OPEC include all 13 member states (including Equatorial Guinea, Gabon, Iran, Libya, and Republic of Congo which do not appear in the global top 20)

Source: OPEC, 'Oil Trade', Annual Statistical Bulletin, 2022, tbl. 5.2.

2.3e Summary

This section outlined the contemporary oil industry, examining four key elements in 2020: reserves, production, consumption, and exports. Global oil reserves are highly concentrated, with 20 countries holding approximately 95.1 percent of proven reserves. Individually, Venezuela and Saudi Arabia had the world's largest reserves, and as a collective, OPEC countries possessed a total of 70.1 percent of all global reserves (BP 2022b). Production rates provide insight into which countries produce high quantities of oil at a particular point in time, but in order to understand the significance of production, it needs to be considered in conjunction with reserves and consumption rates. Production data coupled with reserves data indicate potential longevity and future production scope. Based on these data, it is clear that although the US was the world's largest oil producer in 2020, it was likely producing at an unsustainable rate. Consumption and production data comparisons demonstrate oil security or dependency. Countries with high consumption rates and comparatively low production rates, such as the US, UK, China, India, and Japan, remained heavily dependent on foreign oil to meet their domestic demand whereas OPEC produced far more oil than it consumed (BP 2022b). Finally, export rates can be used to determine power within the industry. As a collective, OPEC has been responsible for between 43.9 percent and 66.2 percent of global oil exports for the last 42 years (OPEC 2022). Their domination over reserves, production and exports indicate that they hold a significant amount of power in the industry.

2.4 Conclusion

In this chapter, I presented an overview of the global oil industry with a focus on power dynamics. I highlighted that while the industry was monopolised for a century by Anglo-American companies, the formation of OPEC in 1960 and subsequent nationalisation of many oil industries resulted in a new power dynamic. Whereas the global oil industry was previously controlled by seven US and UK-based companies, it is now dominated by oil companies (predominantly state-run) in major oil-exporting countries. As a collective, OPEC members are key producers and exporters, accounting for an average of 53.5 percent of global oil exports between 1980 and 2020 (OPEC 2022). They also possess 70.1 percent of the world's proven oil reserves. This indicates that OPEC plays a crucial role in the current oil industry and is likely to continue doing so moving into the future. This exploration of power within the global oil industry is foundational to exploring the transfer of wealth which occurs as a result of the import/export of oil. Chapter 5 will explore the volume and value of this transfer and will build on the findings of Section 2.3 to identify which countries are on both side of this transaction. Chapter 6 will further build on Section 2.3's discussion on oil security/insecurity as well as reserves data to explore the political and economic ramifications of these power dynamics moving into the future as resources become depleted.

Chapter 3. The Global Economic System: Oil, the USD, and War

3.1 Introduction

Throughout this chapter, I argue that one of the factors which contributed to the maintenance of the US as the global economic hegemon following the breakdown of the gold standard was the relationship between the USD and OPEC oil; a relationship that the US has been willing to protect with force. That is not to say that this is the only factor contributing to the economic strength of the US – other factors including population size, possession of resources, their advanced military, and their developed industries also play significant roles in the economic strength of the US – however, the focus of this chapter is the impact of the denomination of oil sales in USDs on US economic hegemony. During the Bretton Woods conference, the USD was institutionalised as the global reserve currency through the international gold standard. In 1971, the US broke away from the gold standard and theoretically the global economy entered a new period where many currencies floated and were not backed by precious metals (Balaam 2014, 188; Engdahl 2004, 128; Gilpin 2001, 238; Helleiner 2014, 84, 185; Kunz 1995, 24; Weatherford 1997). However, due to several strategic agreements between the US and OPEC member states, the USD was – and largely remains – backed by oil. Due to the vital role of oil in economic development, this has effectively ensured that the USD maintained its role as an unofficial reserve currency.

The chapter is divided into three main sections to explore the interrelationship between oil, the USD, and war within the global political economy. First, I explore the hegemonic position of the USD in the global political economy, tracking it from the Bretton Woods Conference through the strategic agreements with key oil-exporters to denominate oil sales in USDs. Second, I explore the role of oil in US foreign policy, arguing that the US has historically engaged in warfare to secure continued access to foreign oil, and to protect the USD-denomination of oil sales. Third, I argue that the US has promoted a strong security state and contributed to a global state of perpetual war as a means to reap greater economic benefits from the petrodollar.

3.2 The Role of the USD within the Global Political Economy

The US has been the economic hegemon since the end of WWII (Breuilly 2011, 406–7; Little 2011, 297). During the Bretton Woods Conference in 1944, the USD was institutionalised as the keystone of the global financial system. The USD was to be the international stable currency against which other currencies operating in the Bretton Woods system would be pegged. In 1971, this system was dissolved and the USD ceased being the official global reserve currency. However, I argue that the USD has largely been backed by oil since 1945, and this has contributed to continued US economic dominance. In this section, I explore this argument by first explaining the gold standard as it was conceived at the Bretton Woods Conference from its implementation to its breakdown in 1971. I then outline the key agreements which facilitated the connection between oil and USDs; most significantly, OPEC's decision to denominate their oil sales in USDs in 1975 (Costigan and Cottle 2018, 163; Robinson 2012; Salameh 2015). I then move to demonstrate how this has resulted in the USD's continuation as an unofficial global reserve currency. Finally, I outline the key benefits of this arrangement for the US economy.

3.2a Bretton Woods and the Gold Standard

Towards the end of WWII, representatives from 44 countries met at the Bretton Woods Conference in New Hampshire to discuss the structure of the international economy and finance system in the post-war period. Several key institutions were formed as a result of this meeting, notably the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (later to become the World Bank Group). The role of the IMF was to manage international exchange rates and the system saw international currencies valued against the USD, and the USD pegged to gold at $35 per ounce. This international gold standard system was intended to facilitate trade while maintaining the stability of currency values. Its foundational premise was that USDs were convertible to gold at a set amount; and thus, USDs were as stable an investment as gold itself. USDs became the primary currency in international trade, and most international transactions were conducted in them. The system set up during Bretton Woods effectively instituted the USD as the global reserve currency (Balaam 2014, 182–83; Clark 2005a, 17–20; Costigan and Cottle 2018; Engdahl 2004, 87; 2008; Gilpin 2001, 236–37; Helleiner 2014, 84; Kunz 1995, 23; Salameh 2015).

During the 1960s, the US printed dollars to fund domestic and international endeavours. Their 'Great Society' program and the Vietnam War were both costly activities which the US could not finance without borrowing or printing money. Ultimately this resulted in far more USDs within the global economy than there was gold to back up their value (Balaam 2014, 187; Calleo 1981, 785–87; Costigan and Cottle 2018, 162; Helleiner 2014, 185; Salameh 2015; Weatherford 1997, 184). Due to the disparity between the amount of gold and number of USDs, President Nixon moved to abandon the gold standard in 1971 and devalued the USD. From this point, the USD floated and the international finance system was based upon fiat currencies; currencies that were not technically backed by a precious metal, but instead only by governments' assurances of their worth (Balaam 2014, 188; Engdahl 2004, 128; Gilpin 2001, 238; Helleiner 2014, 84, 185; Kunz 1995, 24; Salameh 2015; Weatherford 1997). I argue, however, that by this time the USD was largely backed by another resource: oil.

3.2b Oil and the USD

On 14 February 1945, a crucial meeting was held between President Roosevelt and Ibn Saud, the then King of Saudi Arabia. While the meeting was held in secret and thus has no transcript, it is widely accepted that Roosevelt agreed to protect the Saudi ruling family's regime from both domestic and international threats. In exchange, Ibn Saud agreed to secure oil exports to the US, and to denominate Saudi Arabia's oil sales in USDs (Bronson 2006; Clark 2005a, 45; Heinberg 2005, 76; Rutledge 2005, 30–31). This was the beginning of the petrodollar.[28] In 1973, Saudi Arabia *officially* agreed to USD-denomination of oil sales. Whereas the previous agreement was a secret handshake, from 1973 onwards the agreement became public knowledge. By 1975, all other OPEC member states had followed Saudi Arabia's lead and also agreed to denominate their oil sales in USDs (Costigan and Cottle 2018, 163; Robinson 2012; Salameh 2015).

The sale of OPEC oil in USDs was a key factor contributing to the continuation of US economic hegemony following the dissolution of the gold standard. While energy is not the only factor necessary for economic development, it is a vital input connected with economic growth (UNDP 2000). Oil is the largest contributing primary energy source, making up 31 percent of total global energy consumption in 2021 (BP 2022b). As such, every country that does not have a naturally occurring oil supply or does not produce sufficient quantities to meet domestic demand, must purchase oil on the international market. As described in Chapter 2, OPEC dominates the global oil industry. In 2020, they possessed 70.1 percent of global oil reserves and accounted for 46.9 percent of all oil exports. These figures are historically consistent. Over the period 1980-2021, OPEC's oil has accounted for an average of 53.5 percent of total global oil exports (BP 2022b; OPEC 2022, tbl. 5.2).[29] As OPEC trades in USDs, prior to purchasing oil from OPEC, countries must first purchase USDs or earn them on the international market by selling goods and services (Clark 2005a, 32; Shipley 2007, 10–11). The fact that so many exports have been priced in USDs has created continuously increasing demand for the USD, and it has incentivised international central banks to accumulate large quantities of USDs as their reserve currency (Clark 2005a, 32; Salameh 2015; Shipley 2007, 10–11).

The decision by OPEC member states to denominate their oil sales in USDs has benefited the US

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[28] Recall that the term 'petrodollar' refers to the money which is earned by oil-exporting countries in exchange for their oil resources which are denominated in USDs. In other words, petrodollars are the USDs exchanged for oil.

[29] During this period OPEC's contribution to global oil exports ranged from 43.9 percent to 66.2 percent of the global total (OPEC 2022).

economy in four main ways. First, it protects the US from fluctuations in currency exchange rates when it purchases foreign oil because the price remains stable for them (Kunz 1995, 23). This stability incentivises other countries to hold their assets in USDs to also avoid fluctuations in prices, thus solidifying the USD's role as an unofficial reserve currency.[30]

Second, the widespread demand for dollars, and the tendency for states to hold USDs in reserve gives the US the right of seigniorage while somewhat freeing them from the constraints of balance of payment deficits. Under the Bretton Woods system, the US was able to use global demand to print USDs at a low cost and distribute them to other states by importing goods. However, it was theoretically constrained by the quantity of gold it possessed. The ability to print and distribute oil-backed USDs is constrained only by the limits of international demand for USD-denominated commodities, including oil, and global confidence in the stability of the USD. This allows the US to create dollars and distribute them internationally while collecting as profit the difference between the value of the currency and the cost to produce it; seigniorage. States' continued willingness to hold USDs in reserve has allowed the US to finance its ongoing significant balance of payment deficits (Gilpin 2001, 246–56; Helleiner 2014, 188; Robinson 2012; Salameh 2015).

Third, the denomination of OPEC oil sales in USDs has meant that not only is the US economy somewhat protected from fluctuating oil prices, but increased oil prices can in fact strengthen the USD. The oil price shocks of the 1970s provides an example of a time when large oil price increases resulted in increased demand for USDs. Between 1972 and 1980 the price of oil increased by 654 percent (BP 2022b).[31] While most industrialised states experienced inflation and recession and developing states were forced deeper into debt, demand for USDs skyrocketed. Increased prices meant increased international demand for USDs which essentially artificially propped up the US economy in otherwise hard times (Shipley 2007, 12). This is not to say that the US did not experience economic hardship, they too went into recession and their debt increased. However, increased demand for USDs during this time, and the relative ease with which the US

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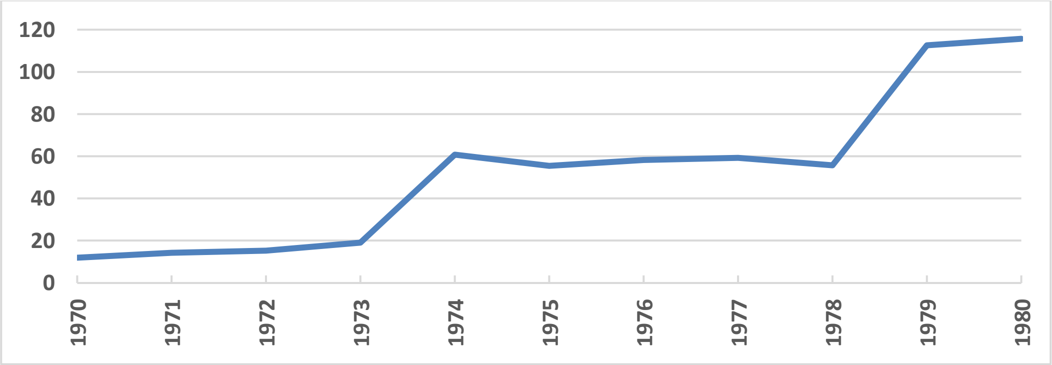
[30] This outcome is not isolated to oil trade alone, it applies to all USD-based commodities, however our focus here is on the benefit of USD denomination of oil sales and an exploration of other dollar-based trade is beyond the scope of this thesis.

[31] The price of crude oil increased from $15.35 per barrel in 1972 to $115.68 per barrel in 1980 (BP 2022b). While most literature on the 1970s oil price spikes relies upon nominal oil prices ($2.48 in 1972 and $36.83 in 1980 (BP 2017)), this thesis uses prices set in fixed 2021 USD. As this thesis tracks oil prices from 1861 through to 2021, using figures which are adjusted for inflation provides a more useful basis for examining trends and comparing price increases over time (see Figure 4.4).

attracted recycled petrodollars through investment and increased exports (as will be discussed in Chapter 6), facilitated the servicing of their debt, and left them less severely impacted than many other countries.

As illustrated in Figure 3.1, oil prices increased from $19.17 per barrel in 1973 to $60.81 in 1974, before increasing again in 1979 to reach $115.68 in 1980 (BP 2022b).[32] Over that same period, consumption rates (while dropping briefly between 1973 and 1975) ultimately increased by 35 percent (see Figure 3.2).[33] This increase in consumption, significant increase in unit price, and the fact that the majority of international oil sales were denominated in USDs meant that over this period, demand for USDs increased (Engdahl 2004, 135).

Figure 3.1: Oil Prices 1970-1980 in fixed 2021 USD (per barrel)



Source: BP, Statistical Review of World Energy 2022

Increased demand enabled the US to print dollars at a low cost and distribute them to other states by importing goods. These dollars were then used to purchase oil. Many of these petrodollars were returned to the US itself in the form of investments, loans, and the purchase of military hardware.[34] After the hardships experienced during the price shock of 1973/4, some countries accumulated USDs to hold in reserve in case of further shocks. By maintaining reserves in USDs, they would be somewhat protected from future spikes and currency fluctuations (Shipley 2007, 10).

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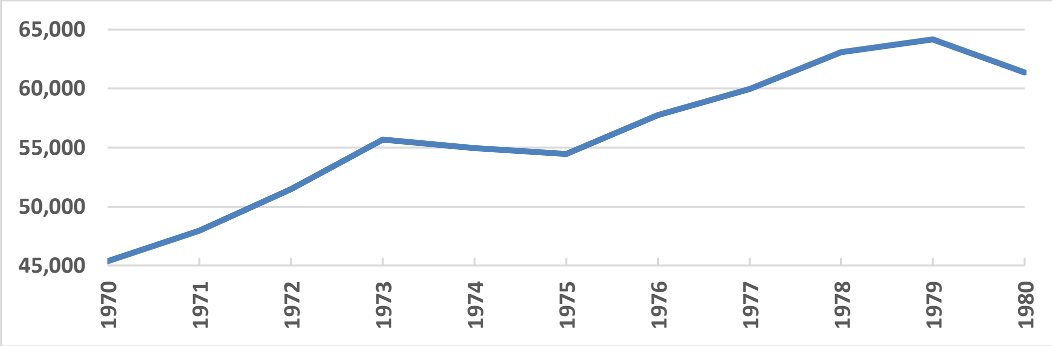
[32] Throughout this thesis, unless otherwise specified, oil prices will be in fixed 2021 USD per barrel.

[33] In 1970, global oil consumption was 45,362 thousand barrels per day. In 1980, global oil consumption had increased to 61,378 thousand barrels per day (BP 2022b).

[34] These recycling mechanisms will be discussed further in Chapter 6.

Figure 3.2: Global Oil Consumption 1970-1980 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022.

The most common argument about the initial spike during 1973/4 is that OPEC was flexing its new-found political muscles and was striving to end Western support for Israel in the Israeli/Palestinian conflict (Balaam 2014, 376; Campbell 1977, 90–97). However, contrasting evidence suggests that the 1973/4 spike was in fact planned and orchestrated with the intention of strengthening the USD and benefiting Western financial interests. Engdahl (2004, 130–38) claims that the spike was planned by the Bilderberg Group – a group comprising 84 of the world's most influential political and financial elite. Shipley (2007, 9–10) agrees, claiming that the US was aware of impending price spikes two years in advance, and even actively encouraged it. Henry Kissinger, the US Secretary of State in 1973, acknowledged in his memoirs (1982) that he was aware that raised energy prices would likely improve the US' comparative situation while harming European and Japanese economies (cited in Shipley 2007, 10). This argument is also supported by Adelman (1972, 79), Di Muzio (2015, 124, 150), Mitchell (2009, chap. 8), and Oppenheim (1976). Although the complicity of the US in the oil price spikes may seem a little far-fetched at first glance, it is indisputable that increased oil prices greatly increased demand for the USD while harming other economies, just as Kissinger had anticipated. This is not to say that all areas of the US economy benefited from the price spikes, nor that all other countries were permanently stunted as a result of the spikes, simply that increased oil prices increased global demand for the USD and helped to secure its position as the global reserve currency.

3.2c Summary

The USD has been the global reserve currency since 1944. Initially it was institutionalised at the Bretton Woods Conference as the currency against which all other currencies would be valued. However, in 1945 President Roosevelt began pursuing another resource to back the USD: oil. The international gold standard broke down in 1971 and President Nixon ended the USD's convertibility to gold, seemingly creating an international fiat system of floating currencies. However, the USD has been connected to international oil since 1945 and has been backed by oil since OPEC officially announced USD-denomination of oil sales in 1975. All countries need to consume oil for economic growth, and the majority of the Earth's oil is located in, and exported from, OPEC. Thus, if countries wish to purchase oil, they need to first accumulate USDs. This has created increased demand for USDs and has contributed to the USD remaining the unofficial global reserve currency even after the breakdown of the gold standard.

3.3 Oil and the USD in US Foreign Policy

It is widely acknowledged that states are willing to wage war to secure access to oil – in the case of the US it is even written into their foreign policy in the Carter Doctrine – however it is important to note that violence has also been sanctioned by states over the *denomination* of oil's trading currency. In this section, I explore the role of oil in US foreign policy. First, I highlight how oil became crucial to US foreign policy and outline two key conflicts over access to oil: the US' involvement in the Soviet-Afghan War, and the Gulf War. Second, I examine two conflicts which were connected to the denomination of oil's trading currency, specifically conflicts which arose in response to attempts by oil-exporting states to deviate from the USD norm: the 2002 Venezuelan coup, and the 2003 invasion of Iraq.

3.3a Oil Access in Foreign Policy

Securing and maintaining access to oil is of the utmost importance to all countries that do not produce sufficient oil to satisfy domestic demand. The crucial nature of oil within the civilisational system (as discussed in Chapter 4) makes it integral to the economies of most countries. While some oil is present in most countries, only a small number produce sufficient oil to meet their domestic demand (see Chapter 2). The majority are, instead, dependent upon accessing foreign oil, and thus access to oil is a key element of foreign policy.

As discussed in Chapter 2, US oil production was first unable to meet US consumption needs in 1948. From this point onwards, the US became a net importer of oil (Enders 1975, 625; Heinberg 2005, 65–75; Parra 2004, 44). In 1970, the need to import oil became systemic when the US reached the peak of its conventional domestic oil production (Deffeyes 2001, 1–4; Heinberg 2005, 75). This meant that half of all of the US' known available conventional oil resources had been extracted, and from this point onwards production was likely to decrease unless substantial new reserves were discovered, or oil prices increased sufficiently to make less accessible oil financially viable. In 1970, US domestic oil production met only 76.9 percent of US demand, leaving a

23.1 percent deficit to be met by foreign oil (BP 2022b).[35] The percentage of US oil consumption met by domestic production has fluctuated over the ensuing decades. Between 1970 and 1977 their dependence on foreign oil production increased.[36] In the years immediately following the oil price spikes, the US' oil consumption decreased while their production rates increased slightly (see Figure 3.3). Due to these trends, their domestic production met approximately 67 percent of their consumption needs from 1982 to 1985.[37] Following this point, however, not only did consumption begin to increase, but domestic production simultaneously began to decrease. This meant that the percentage of domestic oil production compared to oil consumption also decreased, hitting an all-time low of just 34 percent from 2005 to 2007.[38] In other words, the US was dependent on foreign oil to meet 66 percent of their consumption. Between 2008 and 2019, US oil production increased by 152 percent (from 6,783 thousand barrels per day to 17,114 thousand barrels per day). However, even with this significant increase, they still did not produce sufficient oil to cover domestic consumption needs (the shortfall in 2021 was 11 percent).[39]

The dramatic increase to production over the period 2008 to 2019 is likely due to the discovery and exploitation of unconventional oil reserves. While this represents an impressive and significant increase in current oil security, unconventional oil is unlikely to prove a long-term

[35] In 1970, the US produced 11.297 million barrels of oil per day, while it consumed 14.697 million barrels per day (BP 2022b). This left a shortfall of 3.4 million barrels per day. It is important to note that import figures were likely to have been higher than this. Not all domestically produced oil would have been consumed by the US; some of their domestic oil would have been exported and thus larger imports would have been required to meet consumption needs. However, comparing production and consumption rates provides insight into a state's real capability to extract the oil required to meet domestic consumption needs if there were disruptions to the international oil market, therefore providing an indication of oil security.

[36] In 1977, the US produced 9,863 thousand barrels per day, while it consumed 18,431 thousand barrels per day (BP 2022b).

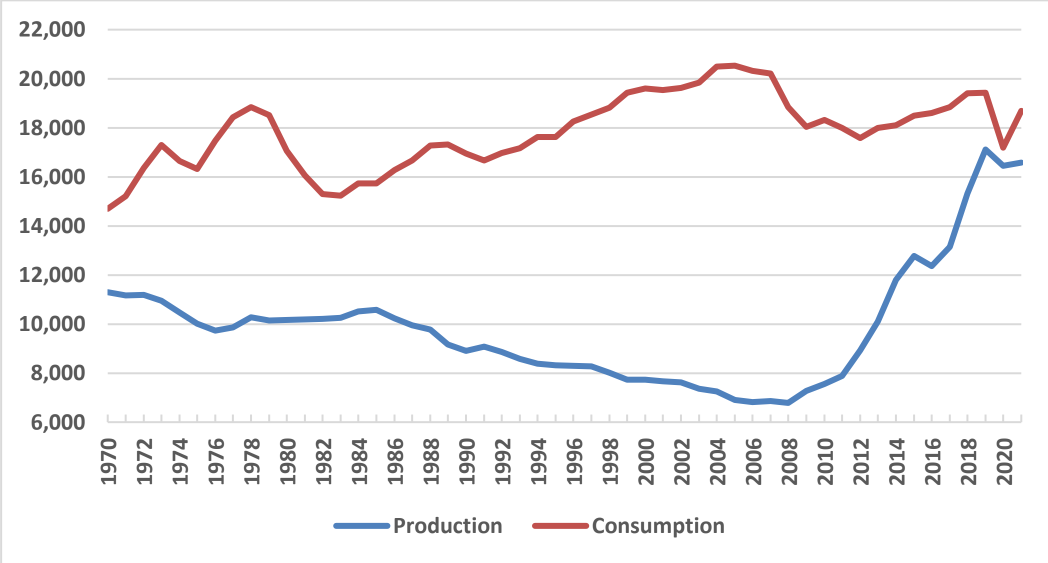
[37] Between 1982 and 1985, the US produced approximately 10,384 thousand barrels per day, while it consumed approximately 15,495 thousand barrels per day (BP 2022b).

[38] Between 2005 and 2007, the US produced approximately 6,861 thousand barrels per day, while it consumed approximately 20,351 thousand barrels per day (BP 2022b).

[39] In 2021, the US produced 16,585 thousand barrels per day while it consumed 18,684 thousand barrels per day (BP 2022b).

solution for dwindling oil reserves (see Section 4.4).

Figure 3.3: US Oil Production and Consumption 1970-2021 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022.

When the above figures are considered in conjunction with the crucial role oil plays in our petro-market civilisation, US dependence on foreign oil becomes abundantly clear. Oil is a necessary input for many sectors of the economy and for economic growth. If for some reason this foreign oil was inaccessible, a portion of the US' demand would not be met and there would be severe ramifications for their economy.[40] The US holds a Strategic Petroleum Reserve (SPR) which can be released in an emergency if supply is disrupted (as do all member countries of the IEA) (IEA n.d.). This reserve is useful for short-term disruptions; however it is not a long-term solution. As of 09 September 2022, the US held 434.1 million barrels of oil in its SPR (Office of Fossil Energy n.d.), equating to approximately 23 days of total US consumption (at 2021 consumption rates), and 206 days of the shortfall between US consumption and production at 2021 rates (BP 2022b). If a severe disruption occurred and production and consumption rates remained steady, the US' SPR would likely become depleted in 206 days, and if an alternative source was not found, nor trade restored during this time, the political economy would face severe ramifications.

Importantly, the majority of the oil that the US imports is produced in countries which history

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[40] This is of course not an issue pertinent to the US alone – it is relevant to all countries that rely on foreign oil to meet their domestic consumption needs.

demonstrates do not share US interests (Heinberg 2005, 75; Watts 2012, 49). In 1998, James Woolsey (former head of the Central Intelligence Agency (CIA)) referred to the Persian Gulf and Caspian Basin as a "volatile region…[whose] governmental and private activity…is not in the U.S. interest, to put it mildly" (Woolsey 1998).[41] As a result, since the early 1970s, much US foreign policy has been constructed around ensuring continued access to oil in these regions.

In January 1980, President Carter brought the importance of foreign oil to the forefront of the political agenda when he announced in his State of the Union Address that oil produced in the Persian Gulf was vital to US security and, as such, the US was willing to protect these oil interests, using military force if necessary (Bronson 2006, 191; Clark 2005a, 45; Klare 2004, 3–4; Levy 1980, 1008–9). The so-called Carter Doctrine was used to justify US involvement in the Soviet-Afghan War. At the time of the Doctrine's conception, the Soviet Union was attempting to spread its influence through Afghanistan, and the US saw this as a potential threat to their oil access in the region. While Afghanistan itself was not a major oil-producer or exporter, it is located within an oil-soaked region and there was fear that instability within Afghanistan could threaten the stability of the entire Gulf. During this period, the non-communist world feared the 'domino effect'; a chain reaction whereby one state's adoption of communism would supposedly lead to neighbouring states also deciding to apply communist policies to their political economic systems. In order to prevent this, the US used the Carter Doctrine as a justification to provide funding and armaments to the *mujahidin* to use against their Soviet-funded enemy (Blum 2003, 338–52; Johnson 2000, 10; Klare 2004, 45–48; Rutledge 2005, 170; Urry 2013, 188).

Since 1999, the Carter Doctrine unofficially expanded beyond the Persian Gulf and into other key oil-producing regions. The US has provided 'assistance' to oil-producing countries within the Gulf, the Caspian Sea, Latin America, and West Africa in the form of financial aid, military training, the installation of military bases, and vocal support for individual regimes (Klare 2004, 132–45). Their actions have demonstrated the US' identification of oil as vital to US national security.

[41] At the time, Woolsey was addressing the US House of Representatives and he was referring to the transfer of petrodollars from oil-importers to OPEC states as a direct result of oil imports/exports. He was alluding to the political and economic threat that this wealth could pose in the possession of OPEC states. Although he was not directly referencing the US' dependence on continued access to oil from this region, his statement can be extrapolated to this context as he was referencing the political, economic, and social leanings of these countries and the economic strength they were accumulating due to the export of oil.

In 1990, both Iraq and the US used military force to pursue their oil interests. On August 2, Saddam Hussein invaded Kuwait and attempted to annex their oil fields. At the time, Iraq was financially strained from the Iran-Iraq War (1980-1988) and was indebted to Kuwait. Both countries possessed large oil reserves, and a successful annexation would have meant that approximately 19 percent of the then-proven global oil reserves would have been under Hussein's control. The control and potential exportation of this oil would have been financially beneficial to Iraq, and presumably annexing Kuwait would cancel the portion of their war-debt owed to Kuwait (BP 2017; Bronson 2006, 192; Klare 2004, 49).

The US interpreted the invasion of Kuwait as a threat to their own national security for three main reasons. First, if Iraq possessed such a high portion of global oil reserves there would be reduced global competition and this could have allowed Iraq significantly more control over global oil prices. Second, possessing such a large portion of global reserves would give Iraq increased power to inflict economic turmoil through any decision to restrict or cut off supply. Third, the US feared that the Iraqi military posed a threat to Saudi Arabian security. The US was heavily invested in Saudi oil, and they had been fostering their influence over Saudi oil for close to six decades (see Section 2.2). Thus, a potential threat to Saudi Arabian security was perceived as a threat to the US national interest. By 12 August 1990, the US military had deployed 250,000 soldiers to Saudi Arabia, soon to be followed by another 250,000. In January 1991, the US began their offensive against the Iraqi military, and by the end of February, Iraq had withdrawn from Kuwait. While other justifications were presented as motivating factors for the US-led Gulf war – namely freeing Kuwait from the atrocities committed under the Iraqi occupation and preventing Hussein from developing nuclear capabilities – it is undeniable that continued access to oil, and influence over the oil industry, played a primary role (Bush 1991; Klare 2004, 49–53; Rutledge 2005, 51–52).

3.3b USD-Denomination in Foreign Policy

As discussed in Section 2.2, the agreement of OPEC to denominate their oil sales in USD has significantly contributed to the role of the USD as the global reserve currency (Clark 2005a; Salameh 2015). This has been highly beneficial to significant parts of the US economy and, as such, the US has invested a great deal of effort into maintaining the relationship between oil and the USD. If large oil-exporting countries were to denominate their oil trade in another currency, oil-importing countries would likely attempt to replace their USD reserves with the new denominating currency. This would result in decreased demand for the USD which would reduce the US' seigniorage and, based on the principle of supply and demand, decrease the value of the USD (Shipley 2007, 12). Several US foreign policy decisions have been made with the intention of preventing such an occurrence. Two examples are discussed below: the US' covert involvement in Venezuela, and their overt involvement in Iraq.

In the late 1990s, Venezuela, led by President Hugo Chavez, attempted to decrease the role of the petrodollar in their oil industry (Miller 2008, 55). After being elected in 1998, Chavez began trading a portion of Venezuelan oil through a system of bartering with 13 other Latin American states. Using this system of directly trading for other commodities, Venezuela was able to completely bypass a USD transaction (Shipley 2007, 16). While the US did not sanction direct military action to enforce Venezuelan use of the USD, evidence suggests that the CIA supported a military coup to overthrow Chavez in 2002. Immediately following the coup, the US recognised and voiced support for the new administration. The success of the coup proved to be short-lived however, and Chavez was reinstated as President within two days. While the US officially denied involvement in the Venezuelan political disruptions, evidence has come to light that they covertly encouraged, and financially supported it. Between 2001 and 2003, $20 million was directed to Venezuelan opposition groups, and CIA documents have been released which indicate that they were aware of the intended coup weeks before it occurred (Clark 2005a, 137; Shipley 2007).[42] While maintaining the petrodollar was not the CIA's only motivation, it seems highly likely that it played a part in their decision to intervene.

Another example of a petrodollar conflict – a much more overt one – is the 2003 US-led invasion of Iraq. Other motivations were presented as justification for the 2003 invasion (and some of them may indeed have played a role in the decision),[43] but a primary motivation was to enforce USD-denomination of Iraqi oil trade. Following the Gulf War, Iraq had been placed under UN sanctions. While still under these, in late 2000, Hussein announced his intention that Iraq would begin selling its oil in euros instead of USDs (Clark 2005a, 27–32; Miller 2008, 55; Salameh 2015). At the time, the euro was gaining value against the USD and once Iraq began reaping benefits from its disassociation with the USD, other OPEC members began to consider making a similar change. At the same time, several European countries started to push for the removal of sanctions on Iraq in order to encourage increased investment in their oil industry and increase the flow of Iraqi oil into the global market. If these sanctions were lifted, and Iraqi oil continued to be denominated in euros, demand for euros would likely have increased and demand for USDs would have decreased (Clark 2005a, 27–36; Shipley 2007). This posed a threat to US economic hegemony.

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[42] Whether or not this figure is in fixed USD is unspecified (Clark 2005a, 137; Shipley 2007).

[43] Justifications included: to protect the Iraqi population from human rights violations, as a pre-emptive strike against a terrorist threat, and to protect the world from Iraq's never-found weapons of mass destruction.

As discussed above, the US maintained its position as economic hegemon partly through the denomination of OPEC oil sales in USDs, and between 1998 and 2000, two key OPEC states with extensive oil reserves were actively looking for alternatives to the petrodollar. There is no hard evidence to connect the economic actions of Chavez and Hussein as a coordinated bilateral move however, in August 2000, the two leaders met to discuss ways that OPEC could increase its role in the global economy. At the time of the meeting, Chavez was already trading Venezuelan oil through a bartering system, and within the following few months Hussein announced his intention to transition Iraqi oil sales to euro-denomination. This timing suggests that oil-denomination was on the meeting's agenda (Shipley 2007, 15). Combined, Iraq and Venezuela possessed close to 15 percent of all proven oil reserves in 2000, and thus if they bilaterally agreed to alternative denomination, it could have posed a threat to the USD's economic hegemony. Based on recorded proven reserves at the time, Venezuela and Iraq's combined reserves were just under 189.3 billion barrels. Multiplying this figure by the price for oil in 2000 ($28.50) gives an indication of what the oil would have been worth; almost $5.4 trillion (BP 2022b).[44] This figure is, of course, only an approximation of what Iraq and Venezuela's oil was worth – in fact, reserves estimates tend to increase over time (by 2020, Iraq's proven reserves had increased by over 30 billion barrels, and Venezuela's had almost quadrupled to 303.8 billion barrels (BP 2022b)). In addition, the price of oil climbed significantly over the following 12 years (as will be discussed in Chapter 4). Both factors indicate that Iraq and Venezuela's oil could be worth a higher figure. However, this approximation provides an indicator of the significance of a bilateral decision from Iraq and Venezuela to bypass the USD in the export of their oil; a potential lost demand of a minimum of $5.4 trillion. In addition, there was the potential for them to encourage other OPEC states to follow suit, either by coercion or by demonstrating increased economic gains.

It cannot be said that the US led an invasion into Iraq solely to reinforce USD-denomination of the oil trade. As with all foreign policy decisions, multiple factors influence and contribute to decision making. However, it is clear that the decision of Iraq and Venezuela to lead the charge in alternative pricing arrangements posed a threat to the strength of the USD. It is also clear that the invasion not only secured Iraqi compliance with the status quo by ending their euro sales, but also served as a warning to other oil-exporting states of the ramifications for denominating in another currency (Chapman 2004; Clark 2005b; 2005a, 27–36; Islam 2003; Shipley 2007; Urry 2013, 189).

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[44] The price of oil and approximate value of Venezuelan and Iraqi oil is in nominal values to provide an indication of the value in 2000.

3.3c Diversification

Since the early 2000s, there has been some diversification in the denomination of international oil trade. Iran and Russia have both denominated their oil sales to Europe in euros (El-Gamal and Jaffe 2009, 123; Salameh 2015; Shipley 2007, 22–26; Urry 2013, 189). In addition, China has been building relations with several key oil producers including Iran, Russia, and Venezuela, which could result in a shift in denomination moving into the future (Salameh 2015; Urry 2013, 121, 189).

In 2007, OPEC discussed the option of collectively moving away from denominating their oil sales in USDs, with both Venezuela and Iran spearheading the move. Saudi Arabia opposed the transition, and the discussion was shelved (El-Gamal and Jaffe 2009, 124). However, more recently, Saudi Arabia has begun negotiations with China to discuss accepting yuan in exchange for some oil purchases. Interestingly, this move is predominantly political. Saudi Arabia has become increasingly dissatisfied with US foreign policy in the Middle East, including their lack of support for the Yemeni civil war, recent negotiations with Iran, and their sudden withdrawal from Afghanistan (Lei, Vizcaino, and Xie 2022; Lucente 2022; Said and Kalin 2022). Recalling that China was the second largest oil consumer in 2020, and Saudi Arabia was the largest exporter, the ramifications of this decision could be extremely significant to the prominence of the petrodollar (BP 2022b; OPEC 2022).

Russia is also further diversifying their oil denomination. In 2021, Russia posited that they may transition further away from the USD to avoid increased sanctions from the Biden administration (Meredith 2021), and in 2022 it denominated several oil sales to India in UAE dirhams (Rosen 2022). In March 2022, President Putin also stated that their gas sales to 'unfriendly' countries ('unfriendly' signifying countries which opposed Russia's invasion of Ukraine) would be denominated in roubles moving forward, and there is some speculation that oil denomination may follow (Mihailov 2022; Somasekhar and Chestney 2022).

It is too early to see any significant economic effects resulting from these recent moves from Saudi Arabia and Russia, however these are two key players in the oil industry. In fact, in 2020, they were the first and second largest global oil exporters respectively (see Table 2.5). These shifts in denomination, and the potential for other exporters to follow suit, could severely impact the strength of the USD and its role as a reserve currency.

3.3d Summary

The US has made foreign policy decisions based upon access to oil since 1945 when President Roosevelt met with King Ibn Saud to discuss providing US military support for the Saudi regime in exchange for access to Saudi oil, and the denomination of Saudi oil sales in USDs. Access to oil became crucial to US foreign policy in 1970 when US conventional oil production peaked and their need to import oil to meet domestic demand became systemic. In 1980, the pursuit of oil in the name of the national interest was formalised in the Carter Doctrine, and from this point onwards protecting the US' interests in oil has dominated their foreign policy. The denomination of oil trade in USDs has contributed to the key role that USDs have played in the global economy following the dissolution of the gold standard in 1971, and the US has demonstrated the lengths it has been willing to go to, to protect the petrodollar.

3.4 Oil, the USD, and the War-Time Economy

In Section 3.3, I highlighted that the US has engaged in warfare to secure access to oil and to ensure the security of petrodollars, but importantly, warfare itself is lucrative to the US economy and can strengthen the USD. This argument touches on the role of the military-industrial complex (MIC) in the US economy but extends beyond this to also address the impact of war on US economic hegemony and the strength of the USD when the US is not directly involved in a conflict. By this, I mean when the US military is not an active, directly engaged participant. However, this is not to say that the US is necessarily *uninvolved* in particular conflicts, as it often arms or finances participants.

In this section, I outline the primary means by which US economic hegemony benefits from conflict. First, I address the MIC. Second, I address the overarching benefits of any international conflict for the US economy; war stimulates increased oil consumption which increases demand for USDs, and war increases arms sales which increases the US GDP as it is the primary global weapons exporter (SIPRI 2021). Third, I outline the benefits that emerge specifically from conflicts in, or near, oil-producing regions. Historically, conflict within these regions has resulted in increased oil prices, which again increases global demand for USDs. In addition, the US can sell weapons to oil-exporting countries to offset their oil imports, thus reducing their own balance of payment deficits. I examine the US' involvement in international conflicts and argue that this involvement has contributed to a global state of perpetual war – by which I mean a state of constant, unending tensions where international actors are continuously either engaging in, or preparing for, conflict. This perpetual state of war has resulted in economic gains for US oil and arms corporations, as well as strengthened the US economic hegemony by maintaining strong international demand for the USD (Bichler and Nitzan 2017; Nitzan and Bichler 1995).

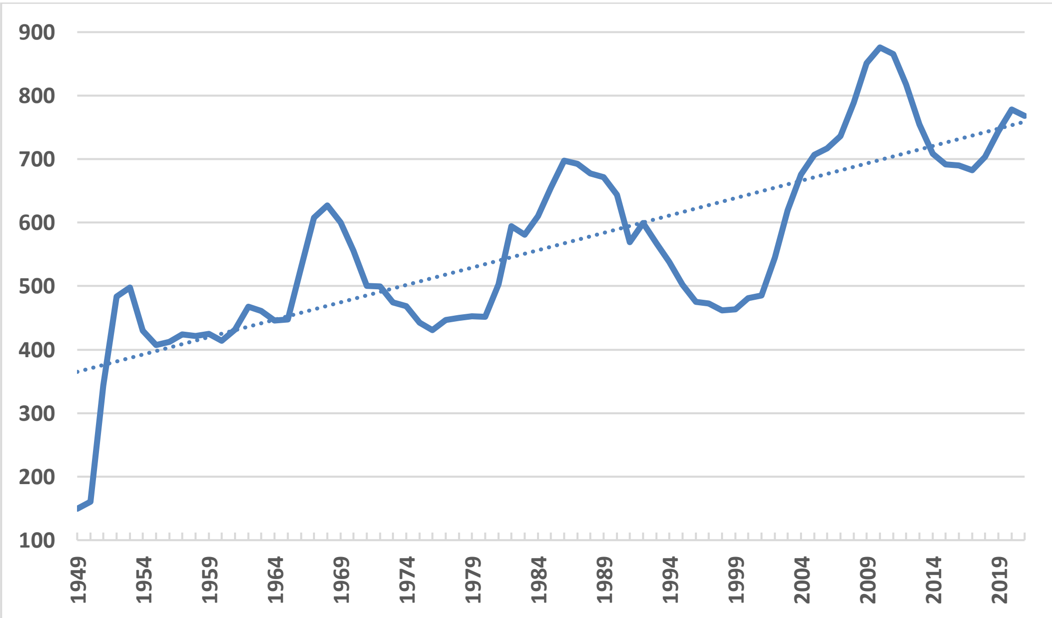
3.4a War and Conflict as an Economic Boon

There is already extensive literature on the US MIC, thus this chapter provides a brief overview rather than an in-depth exploration of the topic, allowing for a deeper investigation into how the USD is strengthened through conflict. The MIC refers to the relationship between the war makers

(Congress), wagers (the Pentagon), and manufacturers (arms manufacturing companies). The concept originates with C. Wright Mills' 1956 text *The Power Elite*, which highlights the power present when the interests of the political, economic, and military elite are combined. He notes the tendency for a revolving door between senior personnel in the military and private defence corporations, as well as the structural shift in the US, post-WWII, towards a permanent war-time economy (Mills 1956). The notion of the MIC was popularised by President Eisenhower in his farewell address in 1961 in which he warned the public of the need to beware of the undue influence of the MIC; the concern being that corporate interests would dictate national interests (Janiewski 2011).

There has been a tendency within the US for a permanent war-time economy, with military expenditure increasing significantly over the last 72 years regardless of the US' direct engagement, or lack thereof, in conflicts (see Figure 3.4). Since Eisenhower's farewell address, US military spending has increased from $431.6 billion in 1961 to $767.8 billion in 2021. However, it is worth noting that while absolute military expenditure has increased, US GDP has simultaneously increased, and US military expenditure as a percentage of GDP has in fact fallen from 9.2 percent in 1961 to 3.5 percent in 2021 (SIPRI 2022a). Nevertheless, a portion of the US economy remains focused on waging, and preparing for war even in times of peace, with the preparation ethos reigning supreme.

Figure 3.4: US Military Expenditure 1949-2021 in fixed 2020 USD (billion)



Source: SIPRI, 'SIPRI Military Expenditure Database', https://milex.sipri.org/sipri, [accessed 25/09/2022].

In addition, the revolving door between government, military, and arms corporations remains fully functional. In the lead up to the 2003 US-led invasion of Iraq and the ensuing 'War on Terror', several political, advisory, and administrative appointments were made of appointees with personal ties to defence contractors. Prior to becoming the Secretary of Defense, Donald Rumsfeld was required to sell his existing personal stock in Lockheed Martin and Boeing (Bieler and Morton 2018, 211). President George W. Bush appointed eight Lockheed Martin officials to fill senior positions at the Pentagon (Porter 2018, 29). In addition, nearly 30 percent of the members of the Defense Policy Board – the board charged with giving independent advice to the Secretary of Defense – had links to defence companies (Politi and Verloy, 2003 cited in Bieler and Morton 2018, 211). The Board chairperson, Richard Perle, had recently set up a venture capital firm whose purpose was to invest in companies which developed services and products relevant to homeland security (Klein, 2007 cited in Bieler and Morton 2018, 211). Naturally, it is problematic when decision makers and 'independent' advisers stand to gain financially from military decisions. And, as with all revolving doors, the flow is cyclical. It was found in 2005, that 80 percent of all three- and four-star generals who left the Pentagon proceeded to take roles with defence contractors (Porter 2018, 29). To quote Mills on his original conception of this phenomenon:

> "It is difficult to avoid the inference that the warlords, in their trade of fame for fortune, are found useful by the corporate executives more because of whom they know in the military and what they know of its rules and ways than because of what they know of finance and industry proper" (Mills 1956, 214).

What this passage suggests, is that positions were likely not awarded to the generals due to their knowledge of the business world, but rather because they had contacts in the military and understood the military's procurement procedures, both of which could prove useful in obtaining defence contracts.

Regarding the MIC, the concern is not only that an alliance between the different branches results in increased domestic defence spending, but also that it could influence decisions to engage in war for the express purpose of financially benefiting a select few individuals. Examining the profit margins and market capitalisation of the arms industry to ascertain who benefits from this system (and by how much) is a worthwhile area of enquiry, however it is beyond the scope of this thesis which focusses instead on the impact of war on US economic hegemony. For an investigation into the impact of the 'War on Terror' on the capitalisation of the weapons (and oil) industry see Di Muzio (2015, chap. 5).

Conflicts can prove beneficial to the US – regardless of their direct engagement – on two counts. First, war is an oil-consumptive endeavour, and oil is predominantly sold in USDs. As will be discussed in Chapter 4, Winston Churchill converted British Naval ships from coal-powered to oil-powered in 1911, tying British military power to consumption of oil from that point onwards (Yergin 2006, 69). Over time, more instruments of war have become oil-based; if it is not necessary for their fuelling, it is still integral to their manufacturing. Machines such as planes, tanks, and submarines are all fuelled by oil,[45] and weapons are manufactured with the input of oil energy. As oil was integrated ever deeper into the production and running of war machines, consumption of oil became increasingly necessary for military security and success (Klare 2004, 148–49). Waging war requires increased oil consumption to manufacture and power war machines and weaponry. As the majority of globally traded oil is denominated in USDs, increased demand for oil naturally means increased demand for the USD. Thus, it could be argued that war, regardless of the US' involvement, strengthens the USD through increased demand and this contributes to its position as the unofficial global reserve currency.[46]

Second, the US economy benefits from conflict (or the preparation for conflict) as they are the largest global manufacturer and exporter of weapons and military machinery. In 2021, all five of the largest global arms companies were based in the US: Lockheed Martin, Raytheon, Boeing, Northrop Grumman, and General Dynamics (Beraud-Sudreau et al. 2022, 9). Figure 3.5 depicts US arms exports as a percentage of global arms exports spanning 71 years from 1950 to 2021. With occasional outlying peaks (58 percent in 1992), the figure has generally fluctuated between approximately 25 percent and 45 percent of the global total. This suggest that the US has cornered a significant portion of the international arms market. Thus, conflict, which requires the accumulation of arms, is beneficial to the US GDP.

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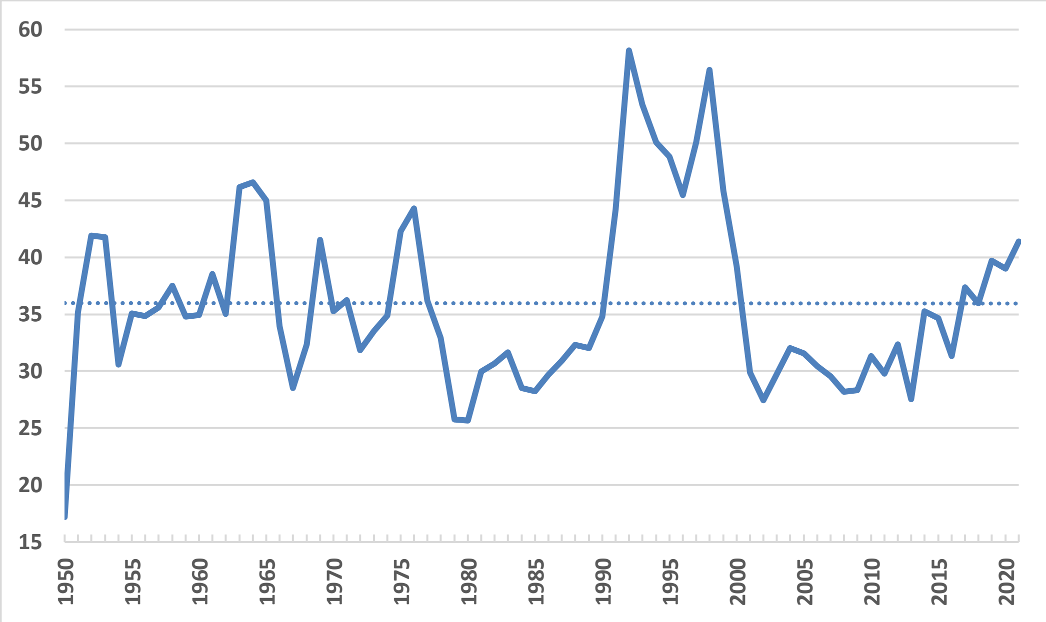
[45] The US and UK both have nuclear-powered submarines, and Australia has recently publicly announced their decision to acquire nuclear-powered submarines over the next few decades (Australian Department of Defence 2021). However, the majority of these machines remain oil-powered.

[46] This is not to simply say that increased oil consumption in war is beneficial to the US across the board. The US military itself consumes more oil than any other institution in the world, and as a result increased demand for – and therefore higher prices of – oil also increases their own costs. In fact, in order to reduce military dependence on foreign oil and the impacts of price fluctuations, the US military has been making strides in energy efficiency, see Breen and Balachandran (n.d. Union of Concerned Scientists).

Figure 3.5: US Arms Exports as a percentage of Global Arms Exports 1950-2021

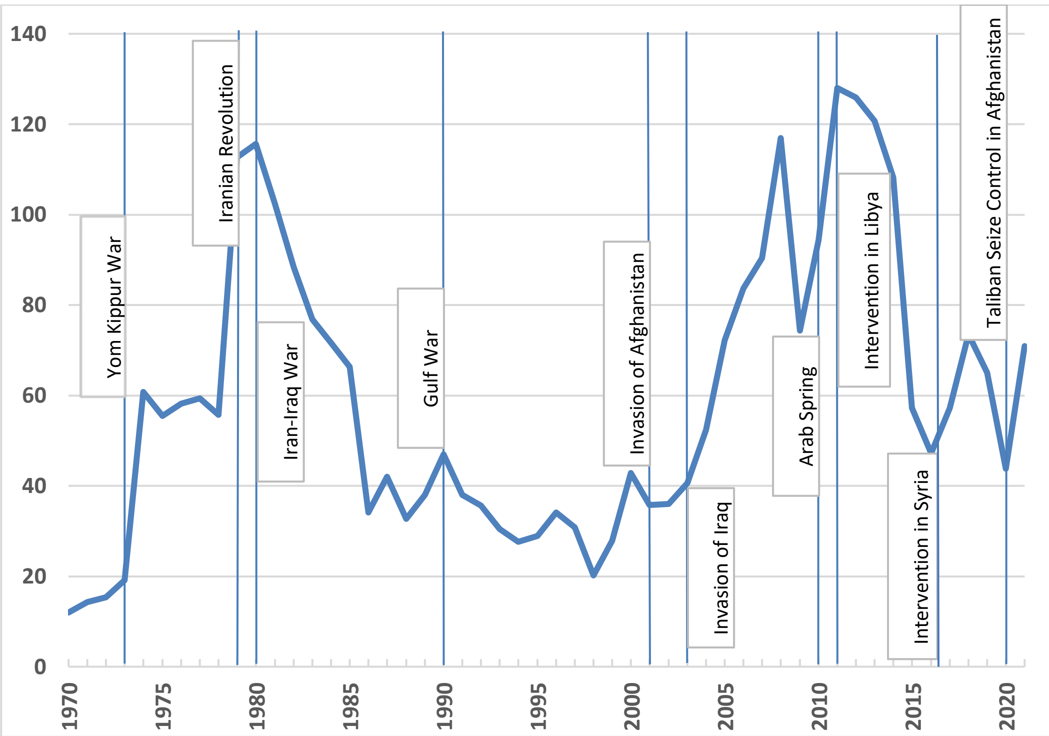


Source: SIPRI, 'Importer/Exporter TIV Tables'. URL https://armstrade.sipri.org/armstrade/page/values.php, (accessed 25/09/2022).

Conflict in, or near, oil-producing regions has historically prompted higher oil prices as conflicts either create production shortages or, more often, *fear of* production shortages (Bichler and Nitzan 2017; Nitzan and Bichler 2002, 229–32; 1995, 491–92). Several examples are available to demonstrate this phenomenon. First, the price of oil spiked with the 1979 Iranian revolution. The global community feared that due to internal conflict, Iran would be unable to meet their production quotas resulting in a global supply shortfall. In response, many governments increased oil imports to create stockpiles as a buffer against the expected shortage. Interestingly, Saudi Arabia, and other key producers were able to increase their own production during this time and prevented an actual shortfall in production. However, due to stockpiling practices where countries were demanding surplus to their normal requirements, an artificial deficit between supply and demand was created, and the price of oil dramatically increased (Hall and Klitgaard 2012, 213).

Other examples are the price increases which coincided with the Iraqi invasion of Kuwait (Nitzan and Bichler 1995, 489), and with the US-led invasion of Afghanistan in 2001 and Iraq in 2003, as illustrated in Figure 3.6. More recent conflicts in the Gulf, including the US-led interventions in both Libya and Syria do not appear to coincide with increased oil prices. This may be due to the lower levels of oil production within those countries compared to the production levels in Iran and Iraq, or due to large oil-producing states producing at unprecedented levels over this period (as will be discussed in Chapter 4). The price of oil increased from 2020, which coincided with the withdrawal of the US-led coalition in Afghanistan and the seizing of power by the Taliban. Another factor which would significantly contribute to the increased prices in 2021 would be the recovery of industry following economic contraction in 2020 due to COVID-19.

Figure 3.6: Oil Prices 1970-2021 in fixed 2021 USD and Conflicts in the Gulf



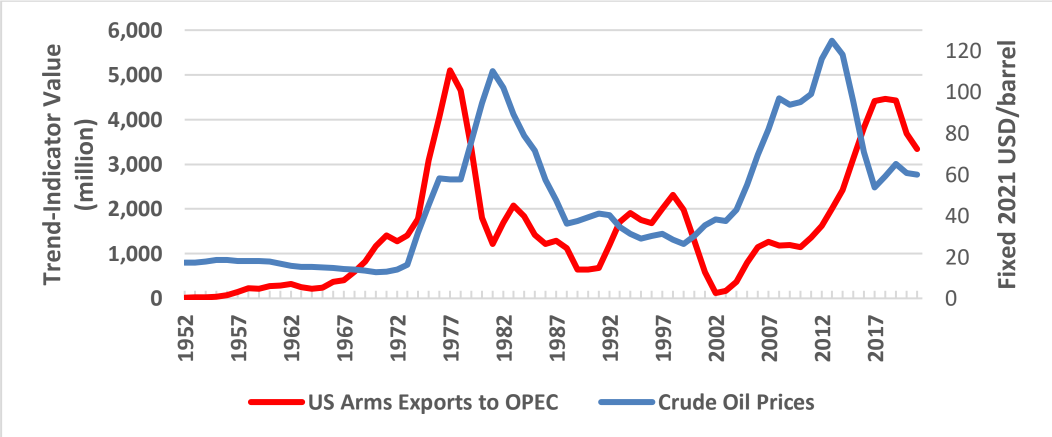
Source: BP, Statistical Review of World Energy 2022.

The outcome of increased oil prices is generally negative for the economies of oil-importing countries because increased spending on oil imports results in decreased spending on other sectors of the economy. However, as discussed above, increased prices can actually benefit the USD. As long as oil is sold in USDs, increased oil prices result in higher demand for USDs. Therefore, it could be argued that the US can benefit economically from conflict in oil-producing regions as it increases the price of oil and demand for the USD.

When the price of oil increases, the US, like other oil-importers, faces trade deficits. However, the US' deficits can be offset to a degree by increasing weapons exports. When the US purchases oil in USDs, oil-exporting countries often use petrodollars to purchase goods and services from the US. Historically, a significant portion of petrodollars have been spent purchasing weapons (Calleo 1981, 792–93; Di Muzio 2015, 133; Klare 1985, 33; Nitzan and Bichler 2002, 217; 1995; Spiro 1999, 87-88,147). Figure 3.7 illustrates the correlation between oil prices and US arms exports to OPEC member states. Three-year moving averages have been used to reduce the fluctuations between years and to provide a broader understanding of the overarching trendlines over this period. As is observable in Figure 3.7, sharp increases in oil prices seem to correlate with increases in US arms exports to OPEC. There was a small peak in oil prices in 1991, which was followed by a spike in arms exports to OPEC within the next few years. The most recent oil price escalation which began in 2002 was followed almost immediately with an increase in arms exports to OPEC in 2003.

Interestingly, US arms exports to OPEC began to sharply climb in the mid-1960s, increasing more rapidly in 1972, *before* the price of oil increased in 1973. This may provide support to the proposal explored in Section 3.2 that US interests were in fact involved in the decision to increase global oil prices in the 1970s. It may indicate a pre-emptive increase in arms sales to OPEC in preparation for an expected trade imbalance resulting from increased oil prices; somewhat alleviating the deficit before it occurred.

Figure 3.7: US Arms Exports to OPEC and Oil Prices 1952-2021 in fixed 2021 USD



Note: Trend-Indicator Values are the unit of measurement used by the Stockholm International Peace Research Institute (SIPRI) for international transfers. It reflects the military capability as opposed to the financial value of the transfers (Holtom, Bromley, and Simmel 2012).

Source: BP, Statistical Review of World Energy 2022; SIPRI, n.d. TIV of arms exports from United States, 1950-2021. URL https://armstrade.sipri.org/armstrade/page/values.php, (accessed 25/09/2022).

By successfully increasing their arms exports to oil-exporting countries, the US has been able to mitigate some of the financial hardships associated with dependence on foreign oil.[47] Naturally, oil-exporting countries are more likely to purchase weapons if they are experiencing an armed conflict or fear a future conflict. Thus, there are direct economic benefits to the US economy if

[47] This will be explored further in Chapter 6.

there is conflict in oil-producing regions as it facilitates increased weapons exports and stimulates the US economy while helping to finance their balance of trade deficits; all the while increasing the global demand for USDs.

3.4b Perpetual War

Due in part to the economic benefits outlined above, it can be argued that the US has contributed to a global state of perpetual war. Since 1941, it has almost constantly been either directly involved in a conflict, funding conflict, facilitating conflict, or prompting conflict. When the US has been overtly and directly engaged in a war effort (for example WWII, the Korean War, Vietnam War, Gulf War, Afghan War, and Iraq War) its methods for promoting warfare are clear; they actively participate. When it is not directly engaging another country or countries in conflict, its involvement can be more surreptitious. The primary ways that the US has indirectly stimulated warfare are by supporting dissidents, insurgents, or opposition groups within certain countries, and by selling weapons.

The CIA has been involved in covert operations aimed at destabilising or overthrowing foreign administrations which it deems to be undesirable and thus stimulating conflict since shortly after its establishment in 1947 (Blum 2003). One of the first recorded CIA operations with such intentions was the 1953 overthrow of the Mossadegh administration in Iran in retaliation for Mossadegh's move to nationalise Iranian oil production (Blum 2003, 64–72; Klare 1985, 111). Since then, numerous such missions have been carried out around the world. One notable example is the 1973 military coup in Chile which saw the democratically elected leader Salvador Allende replaced by the authoritarian General Pinochet. Declassified CIA documents confirm their involvement, including plans to destabilise the regime with the intention of spurring a military coup. The successful coup led to a tyrannical regime which lasted for the following 17 years during which time thousands of people were tortured or killed (Blum 2003, 206–15; Johnson 2000, 18). Another notable example, discussed earlier, is the US' involvement in the failed Venezuelan coup in 2002. The CIA has implemented similar policies in many countries, including the Congo, Guatemala, and Türkiye (see Blum 2003 for a comprehensive exploration; Johnson 2000, 13–17). All of these interventions resulted in insecurity, instability and violence to varying degrees.

Many of these US-run clandestine activities resulted in immediate conflict, but others had more protracted implications. The US involvement in the Soviet-Afghan War is an example of particularly enduring ramifications which eventually prompted the US to declare a war without end; the 'War on Terror'. During the 1980s the US provided funding and armaments to the *mujahidin* in Afghanistan to assist them in driving the Soviets out of Afghan territory (Blum 2003, 338–52; Johnson 2000, xii; Rutledge 2005, 170). The US extended the operation beyond Afghan borders and encouraged their ally, Saudi Arabia, to help the *mujahidin* by recruiting and training fighters. One infamous Saudi citizen who received funding for this was Osama bin Laden (Johnson 2000, 10; Klare 2004, 45–48; Rutledge 2005, 170; Urry 2013, 188). Once the immediate Soviet threat to the Gulf had passed, the US removed itself from the Afghan conflict and in the chaos that ensued, the Taliban rose to power, creating instability and internal conflict. In the 1990s, bin Laden grew disenchanted with the US, due to their failure to remove US troops from Saudi Arabia at the conclusion of the first Gulf War. Bin Laden was reclassified by the US as an enemy when he orchestrated attacks on two American embassies (Johnson 2000). The US military retaliated by bombing his training complex and weapons storage tunnels, and as Johnson (2000, xiv) stated "…the CIA knew exactly where the targets were, since it had built them". Ultimately, bin Laden's frustration culminated in the attacks on US soil on 11 September 2001. The US responded by first declaring war on Afghanistan, then declaring war on Iraq, and finally by announcing a 'War on Terror'. This is a war against a tactic rather than an enemy, and therefore one that can never be concluded. It is a perpetual war that was in part caused by the US intervention itself (Johnson 2000; Klare 2004, 45–48; Rutledge 2005, 170; Urry 2013, 188).

The CIA knew that their international covert operations were likely to have ramifications. They defined this as 'blowback', the expected retaliation against the US for clandestine intervention within foreign territories. Chalmers Johnson (2000) explores blowback and provides context for attacks on America and Americans by drawing connections between attacks and preceding US operations. Johnson addresses blowback as an unintended consequence, whereas I suggest that while it is perhaps not a desired outcome, it may not have been entirely unwelcome, due to the benefits of perpetual war to the US MIC.

The US' key role in the international arms industry has contributed to its perpetuation of global conflict. It is the world's largest arms producer and exporter, and over the past five years it has sold weapons to 98 states (Wezeman et al. 2018, 3). Thus, it could be said to be contributing to the militarisation of approximately half of the world's states. The US has also shown a tendency for exporting weapons to states on opposing sides of a conflict (Nitzan and Bichler 2002, 250). Some examples include simultaneously exporting weapons to Iran and Iraq,[48] Saudi Arabia and Israel,[49]

[48] The US exported weapons to both Iran and Iraq 1956-1958 and 1985-1986 (SIPRI 2022c).

[49] The US exported weapons to both Saudi Arabia and Israel 1952-1959, 1961-1962, 1965-1968, and 1972-2022 (SIPRI 2022c).

India and Pakistan,[50] Türkiye and Greece,[51] as well as to Indonesia and the Indonesian rebels (SIPRI 2022c).[52] Arming both sides seems likely to increase the longevity and volatility of a conflict or potential conflict. The US has also historically armed those who they would later declare to be their enemies. The provision of weapons to the *mujahidin*, including to Osama bin Laden, in the 1980s is one example. Other examples include selling weapons to Iraq throughout the 1980s, and to Iran right up until 1986; both countries were later declared to be in the so-called 'axis of evil' by President George W. Bush (Klare 1985, 108; SIPRI 2022c). By militarising these states, the US facilitated future conflicts.

While the examples presented above range from 30 to 40 years ago, the US has continued the same pattern in more recent years. During the period 2013 to 2017, the Middle East increased its weapons imports from the US by approximately 83 percent (SIPRI 2022c). During this time almost all countries in the Middle East were directly involved in a violent conflict (Wezeman et al. 2018, 10). Historically, the export of US weapons has either contributed to, exacerbated, or facilitated international conflict. While US arms exports decreased dramatically between 1998 and 2002, they have been climbing once again, reaching $US10.6 billion in 2021 (SIPRI 2022c). This is likely contributing to current and future global hostilities from which the US arms industry, oil corporations and the USD will likely benefit.

3.4c Summary

The primary benefits of warfare to the US economy have been outlined above. War typically increases consumption of, and therefore demand for, oil. In addition, it often increases the price of oil. Both outcomes increase the demand for, and therefore strength of, the USD. Furthermore, the US is the world's largest weapons manufacturer and exporter, thus their GDP benefits from global warfare. Historically, the US has encouraged perpetual warfare by either actively participating in conflicts, promoting them by funding one or more groups in a potential or actual conflict, or facilitating them by selling weapons to all comers.

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[50] The US exported weapons to both India and Pakistan 1954-1957, 1961-1963, 1968, 1973-1976, 1988, 1994, 2006-2007, 2010-2018, and 2020 (SIPRI 2022c).

[51] The US exported weapons to both Türkiye and Greece 1950-2022, with the exception of 2013 when they did not export to Greece (SIPRI 2022c).

[52] The US exported weapons to both the Indonesian state and Indonesian rebels in 1958 (SIPRI 2022c).

3.5 Conclusion

The US has been at the centre of the international economic system since 1944. It was first institutionalised there at the Bretton Woods Conference which determined that the USD would be the stable global currency to facilitate international trade, the keystone of the economic system. While the USD was initially backed by gold, the US began courting oil as a more lucrative resource. By 1975, the majority of global oil was sold in USDs, and this meant that the USD could remain the unofficial global currency even after it was dissociated from the gold standard. All countries require oil energy as an input to their economies, and as most do not produce sufficient quantities to meet their domestic demand, they must import oil. The denomination of international oil in USDs means that all countries who wish to purchase oil must first obtain USDs. The US has focussed much of its foreign policy on ensuring access to foreign oil, as well as maintaining the position of the petrodollar. If large portions of global oil sales were priced in alternate currencies, the hegemonic position of the USD could be impacted, and this could prove damaging to the US economy and the value of the USD.

To ensure continued USD-denomination of the oil trade, the US has engaged in both clandestine and aggressive operations. These activities often result in conflicts which tend to further strengthen the USD. Conflicts consume oil, and if they are in or near oil-producing regions they tend to increase the price of oil. Both outcomes increase demand for the USD and thus reinforce the role of the USD as the global reserve currency. War has the added benefit of increasing arms sales which also benefit portions of the US economy; creating an incentive to perpetuate ongoing international conflict.

Chapter 4. The Escalating Trajectory of Oil Prices and the Potential Implications

> "Oil is the lifeblood of modern civilization. It fuels the vast majority of the world's mechanized transportation equipment – Automobiles, trucks, airplanes, trains, ships, farm equipment, the military, etc. Oil is also the primary feedstock for many of the chemicals that are essential to modern life… The earth's endowment of oil is finite and demand for oil continues to increase with time. Accordingly, geologists know that at some future date, conventional oil supply will no longer be capable of satisfying world demand" (Hirsch, Bezdek, and Wendling 2005, 8).

4.1 Introduction

In this chapter, I address my research question '*How will petrodollars impact the global political economy if consumption rates continue, and resources continue to deplete?'* by arguing that without significant advancements in the development of alternative energy, the price of oil is likely to escalate into the future with detrimental impacts for the global political economy. According to the Hirsch report, as a non-renewable energy resource with high consumption rates, oil reserves are likely to become depleted (Hirsch, Bezdek, and Wendling 2005). Unless significant developments are made in a timely manner to assist in a transition away from oil as a key energy source, the likely result will be a shortfall between supply and demand. If this is the case, the price will likely increase.

This chapter is divided into four main sections. First, I explore the role of oil in the global political economy by tracking its integration into our civilisational order, beginning with its initial applications, and concluding with its position as the main contributing energy source within the contemporary global political economy. Second, I track key oil indicator trends including oil prices, consumption, reserves, and production rates to determine how the industry has developed and become more consequential over time. This is followed by an analysis of the oil industry using the peak oil hypothesis where I argue that scarcity without dramatically decreased demand will inevitably lead to increased oil prices.

One of the prime arguments charged at the peak oil hypothesis is that it disregards the ability of the market to facilitate a transition to alternative energy sources. In Section 4.4, I address this argument by exploring the potential for alternative energies to replace oil to a degree sufficient to avoid severe energy and economic disruptions resulting from the depletion of oil reserves. I evaluate the two key sectors which consume the greatest quantities of oil: transportation and petrochemicals. Ultimately, I argue that while advancements are being made which could delay depletion, consumption of oil is likely to continue or even increase over the next few decades (BP 2019; IEA 2021; OPEC 2021), and therefore the depletion of oil reserves is still likely to occur. Finally, I explore the potential implications for the global political economy of increased oil prices. While the outcomes of oil depletion are difficult to predict with any certainty, I use the best available datasets from authoritative institutions like BP, the Energy Information Administration (EIA), IEA, and OPEC to parse out future projections and examine previous oil crises to ascertain potential future outcomes. In this latter regard, I outline the main political economic implications of the oil price shocks of the 1970s, as well as a short-lived crisis experienced in Europe in 2000. These examples provide insight into how increased oil prices could affect the political economy, with one key difference: in the future, the rising price of oil is unlikely to be temporary.

4.2 The Role of Oil in the Global Political Economy: ever increasing dependence

In this section, I explore the role of oil in the global political economy and argue that its consumption has become vital to our contemporary civilisational order, which is dependent upon engagement with the market, mass production, and long-distance trade. I begin by outlining the primary uses of oil, commencing with its rudimentary applications, then tracking its development and application to key sectors in the current global economy. Finally, I demonstrate its crucial role in petrochemicals, agriculture, and transportation.

4.2a Initial Uses

Oil has been used throughout the world by many different cultures for thousands of years before it was commercialised and extracted on a massive scale. As far back as 3000BC, the Mesopotamians captured bitumen as it seeped to the earth’s surface and used it for a variety of purposes such as illumination, a weapon in warfare, and a building material. Native Americans used oil as a cure-all medicine which treated everything from wounds to headaches. They collected it by skimming oil residue off the surface of rivers and creeks (Yergin 1991, 19–24). These methods of collection allowed humans to access visible oil, however they did not tap into oil reservoirs hidden beneath the ground. With the introduction of drilling for oil (as discussed in Chapter 2), humans were able to tap this previously inaccessible wealth of fossil fuel energy.

Initially, the primary market for commercially available oil was as a source of light. It was refined into kerosene and was sold as lamp fluid which was more affordable than the traditional whale fat. During the beginning of the 17th century, light was a burgeoning market. With ever increasing industrialisation, light became a necessary factor of production; it lit the factories and extended the working day beyond the constraints of daylight hours (Yergin 1991, 22–23). Over time, this market dried up with the invention of the electric light bulb in 1882. Electrification was not only more efficient than oil lamps but far safer for consumers (Di Muzio 2015, 105; Yergin 1991, 63). The oil industry was threatened by this development since its primary product was kerosene for light.[53]

Conveniently, at this time the combustion engine was invented, and this opened a new market for oil: to fuel transportation. Initially, the combustion engine was only utilised in automobiles which were relatively rare. However, over time they became increasingly popular. One cause of this popularisation was through a process Veblen (1904/1965) described as sabotage (Nitzan and Bichler 2009, 217–48). In the 1920s, General Motors and Standard Oil of California began strategising a method to increase car sales, and therefore demand for oil. They purchased existing electric streetcar companies, which were used as public transport, and replaced them with oil-run buses. They then reduced the scope and frequency of services at the same time as increasing fares. The decreased functionality of public transport, coupled with growing costs for commuters, resulted in a shift away from public transport use and towards increased purchases of private cars (Barnet 1980, chap. 2; Heinberg 2005, 69; Rutledge 2005, 15–17). Through this example, we can see how sabotage of the public transportation industry increased the incentive to purchase private cars and therefore increased the demand for oil. Private ownership of cars became even more important with the trend of suburbanisation. As more people moved from polluted city centres into suburbs from which they commuted to work, they became increasingly dependent on personal cars for transportation, and thus increasingly dependent on oil (Di Muzio 2015, 107; Rutledge 2005, 17; Urry 2012, 568).

Oil also secured a monopoly over the shipping industry. Between the 1840s and the early 1900s, coal was the mainstay of the shipping sector. However, at the commencement of WWI, Winston Churchill decided to run the British Navy on oil (Yergin 2006, 69). This decision revolutionised the shipping industry. Oil-run ships used less human energy, they could accelerate faster and maintain speed more efficiently, and they were easier to refuel than coal-powered ships (Di Muzio 2015, 78; Engdahl 2004, 19). Of course, this improved method of powering ships did not simply increase naval capacity, it also facilitated faster global transportation which assisted in creating a globally interconnected economy which encouraged transnational supply chains and trade. Through its implementation in the shipping industry, oil was a contributing factor which helped to escalate international trade which has become a core characteristic of the contemporary economic system.

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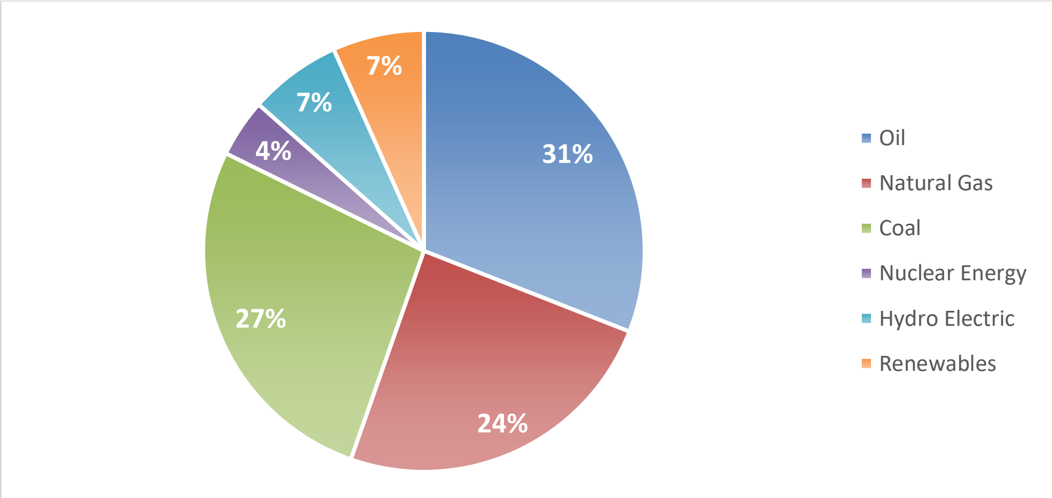
[53] Of course, it should be noted that the transition to electrification did not happen overnight but was a gradual process (see Hughes 1993).

4.2b Increased Uses

According to data from BP (2022b), oil is currently the largest contributing energy source in global energy consumption. In fact, in 2021, oil constituted 31 percent of total global energy consumption, meaning that it supplied close to one third of the global energy needs for that year.

Figure 4.1: Global Energy Consumption by Fuel Type in 2021

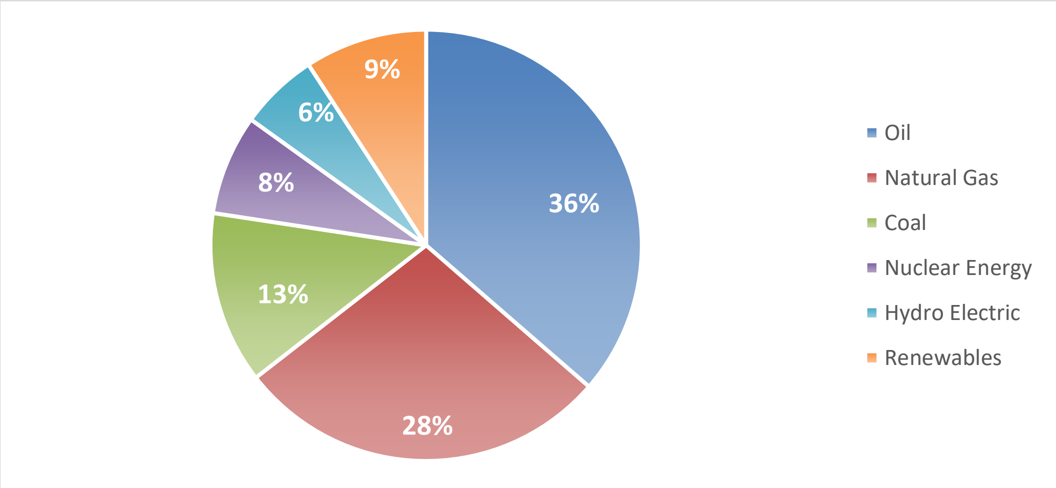


Source: BP, Statistical Review of World Energy, 2022.

The contribution of oil to total global energy consumption has been in gradual decline over recent years. In 2016 it constituted 34.7 percent of total global energy consumption, meaning that between 2016 and 2021, its contribution decreased by 3.7 percent (BP 2022b; 2017). However, despite this small decline, it remains a vital source of global energy.

The contribution of oil to total energy consumption is even more significant within OECD countries. Figure 4.2 illustrates that within OECD countries, oil contributes more than a third of total energy consumption (36 percent). The continued reliance of OECD countries on oil as the largest contributing energy source is significant. The majority of the 38 OECD member states are high-income countries with advanced capitalist economies. If any collective group of countries were better placed than others to transition away from oil as a key energy source, it would have to be OECD countries. These countries have relatively higher GDPs, and the technology and capital to develop and harness non-fossil fuel-based energy. However, while there has been a decrease in oil reliance over the last five years (in 2016, oil constituted 39.5 percent of total OECD energy consumption), the OECD remains heavily dependent on oil to meet energy consumption needs.

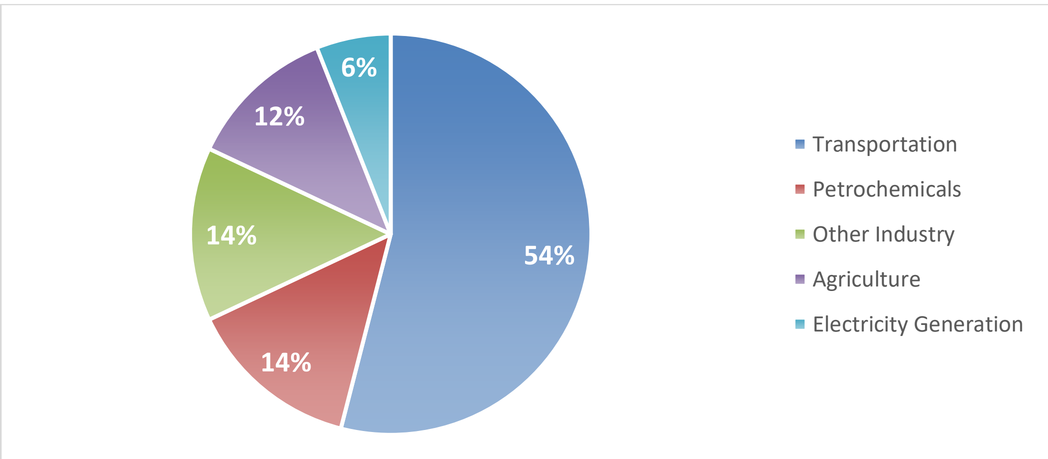
Figure 4.2: OECD Energy Consumption by Fuel Type in 2021



Source: BP, Statistical Review of World Energy, 2022.

Oil is essential for the production and manufacturing processes of virtually all products exchanged on the market (Hall and Day 2009, 237; Urry 2012, 567). In fact, oil is so prevalent in the market system that Hall and Klitgaard (2012, 95) have posited that each USD spent by a consumer reflects approximately enough oil to fill a coffee cup. Oil is "central to virtually every aspect of our lives…showing up in everything from asphalt to milk shakes to drugs to plastics to fertilizers…the lifeblood of just about everything" (Watts 2012, 438–39). This wide spread, extensive use of oil has led scholars to contextualise modern society as inhabiting the 'Age of Petroleum' (Hall and Klitgaard 2012, 72).

Figure 4.3: Global Oil Consumption by Sector in 2020



Source: OPEC, World Oil Outlook 2045, 2021, tbl. 3.3.

Figure 4.3 illustrates the distribution of oil consumption by sector in 2020. It indicates that more than half of all oil consumption was used by the transportation sector (54 percent). 28 percent was utilised by industry, with half of that being used to make petrochemicals. Agriculture consumption made up 12 percent of the total oil used, and only 6 percent was consumed in the production of electricity (OPEC 2021, tbl. 3.3). Three sectors are of key interest due to their impact on the contemporary political economy: petrochemicals, agriculture, and transportation. This is not to say that the other sectors are insignificant, simply that the aforementioned sectors best represent our current reliance on oil. All three will be explored below.

4.2c Petro-market Civilisation

Contemporary civilisation is built upon a market-based economic system which is contingent upon the continued consumption of fossil fuels, especially oil (Di Muzio 2015; 2012, 73–88). The contemporary global economic system, coupled with patterns of urban development, compel people to engage with the market to satisfy their survival requirements. Rather than practicing self-sufficiency, the majority of humanity rent out their labour for a wage, which they can then exchange for goods and services produced by others (Polanyi 1957). This has become an international process whereby many people engage in an international market characterised by energy intensive production, extreme specialisation of labour, and transnational supply chains. These processes are currently dependent upon fossil fuel energy, especially oil.

Petrochemicals are chemicals derived from petroleum. They are an ingredient in many manufactured products which have become foundational to modern life. These products include (but are far from limited to): rubber, plastics, synthetic fabrics, detergents, medicines, pesticides and fertilisers, paints, smartphones, solar panels, wind turbine blades, and batteries (American Fuel & Petrochemical Manufacturers n.d.; IEA 2018).[54] While many of these products are not necessary for survival (with the stark exception of medicines), they have become commonplace and a dramatic reduction to their access would require a significant lifestyle transformation. The potential for replacing petrochemicals with alternatives will be discussed in Section 4.4.

The second sector of crucial importance regarding oil consumption is agriculture. The contemporary market system promotes large-scale, energy-intensive food production such as factory farming and cash cropping that uses large quantities of oil throughout the process from farm to table.[55] The application of oil to the agriculture process has allowed for increased output

[54] Their use in the manufacturing of renewable energy technology poses an interesting question as to the sustainability of these technologies unless alternative ingredient materials are developed.

[55] It is important to note that not all food is produced in this manner. Some farms produce food on a smaller scale with the intention of supplying fewer consumers. In addition, there are also farms which use less fossil fuels in their production but still engage with the market system.

and larger farms to focus on mono-production. Oil-fuelled irrigation has allowed the tending and sustenance of large tracts of land beyond natural rainfall constraints. Similarly, oil-fuelled machinery has contributed to the feasibility of large-scale agriculture. Pesticides made from petrochemicals have reduced crop losses due to pests. Fertilisers (also made from petrochemicals) have reduced the need for crop rotation by countering some of the soil depletion resulting from repeat mono-cropping. In addition, much packaging, refrigeration, and transportation of products are produced or fuelled with oil (Campbell 1977, 196; Heinberg 2005, 193; Pimentel and Pimentel 2008; Rhodes 2017, 233). It is estimated that within this system approximately ten calories of oil are expended for every calorie of food produced (Hall and Klitgaard 2012, 216; Pfeiffer 2006, 21).

One outcome of this oil-drenched agricultural process is that greater levels of food production have become possible, and this has facilitated the sustenance of larger populations. As outlined in Chapter 1, in 1798, Malthus posited that food production and population growth increased at different rates, and that at a certain point, human population would exceed the global food supply. The result, he claimed, was that there would be a large-scale die-off which would forcibly reduce global population to fit with agriculture capacity (Malthus 1798).[56] Except in exceptional circumstances (such as drought and war), this outcome has thus far been avoided despite the exponential population growth which has occurred over the last 200 years. This has been partially attributed to the extensive use of fossil fuels – particularly oil – in food production. The use of oil, amongst other fossil fuels, has increased our agriculture output and effectively extended the carrying capacity of the earth (Hall and Day 2009, 230–31; Manning 2004; Pfeiffer 2006). If this is the case, it may pose a challenge to the global community if (as I argue in Section 4.3) oil supplies deplete and the price of oil increases moving into the future. Dramatic increases in oil prices are likely to also increase the price of food (as well as other products made with the use of oil). Importantly, increased food costs are likely to affect the poorest and most vulnerable populations first.[57] Additionally, as reserves become depleted, the existing agriculture process may be unsustainable unless an alternative energy source with the same characteristics as oil can be adopted by the industry without significant interruptions to output.

[56] As outlined in my theoretical framework (Chapter 1), while I engage with Malthus' notion of population growth necessarily remaining in line with food production, I neither engage nor agree with his perspective on poverty and welfare.

[57] The food crises of 2007 to 2008 present an example of this. Over this period, several factors (including oil-price increases), resulted in significantly higher food prices. Predictably, more vulnerable populations were the most significantly affected, and several countries experienced food riots (see Berazneva and Lee 2013; Ross 2017).

A second outcome of this agriculture system and the transnational division of labour is that people have become increasingly divorced from the means of food production. Today, many people have insufficient access to land to produce food, let alone the knowledge required to do so. Instead they are dependent on purchasing food within the market (Di Muzio 2015, 45). This demonstrates how crucial continued access to large-scale food production currently is within our civilisational system. Significant disruptions to oil supply, or significantly increased prices, would likely impede many people's access to food, a necessary commodity for survival.

The third sector crucially dependent upon oil is the transportation sector. In 2019, oil contributed 91.3 percent of the total energy consumed by the transportation sector, meaning that less than nine percent of the energy required for global transportation came from a non-oil energy source (IEA 2021, 47). Oil is integral to road, rail, air, and sea travel and, as such, it is essential for long-distance trade which is characteristic of the global market system (OPEC 2017b, 15). International specialisation and transnational supply chains only remain feasible if products can be transported internationally at a reasonable cost, and this transport is currently highly dependent on oil consumption (Rodrigue, Comtois, and Slack 2006). Winston Churchill noted the crucial nature of oil within the economy in a statement he made to the British Parliament in 1913 where he said "If we cannot get oil, we cannot get corn, we cannot get cotton and we cannot get a thousand and one commodities necessary for the preservation of the economic energies of Great Britain" (cited in Yergin 1991, 160). If we replace 'the economic energies of Great Britain' with 'our civilisation', the statement still rings true. Without transportation we would not be able to access products which were produced internationally, or even domestically beyond the potential of human or animal mobility. By divorcing ourselves from the means of self-sufficiency and instead encouraging extreme international specialisation, the majority of humanity has become dependent upon trade and therefore transport for survival. Oil is crucial to the transportation sector (and, as will be explored in Section 4.4, it is expected to remain so) therefore the perpetuation of our contemporary economic system remains contingent upon uninterrupted access to affordable oil.

4.2d Summary

This section demonstrated the crucial role of oil within the global economy. Initially marketed as simply a source of light, oil has become vital to the continued reproduction of our contemporary civilisation. Oil was gradually applied to the manufacturing and production of virtually all goods distributed in the market. And most importantly, it is integral to our petrochemicals sector, the agriculture sector which facilitates the survival of our population, and the transportation sector which is necessary in an economic system dependent on long-distance trade.

4.3 Oil Price Trends

This section will explore historical trends in oil prices and will argue that given high consumption rates and depleting reserves, the price of oil is likely to escalate moving into the future. I begin by tracking oil prices from the establishment of the oil industry until 2021. This is followed by an examination of oil consumption rates from 1965 to 2021, as well as a summary of the industry leaders' projections for future consumption. These figures indicate that oil consumption has been continuously increasing over the previous five and a half decades, and it is likely that consumption will either decrease slightly while remaining high, or will increase over the next few decades (BP 2019; IEA 2018; OPEC 2021). When proven oil reserves and peak oil are considered, it appears likely that if high consumption rates continue without significant new oil discoveries, oil prices will increase in the decades to come.[58]

Before this, it is important to note that predicting oil prices and reserves is a notoriously difficult and contested subject. The ensuing exploration should not be interpreted as definitive predictions of future prices, reserves, consumption, or depletion. Rather, my arguments should be taken as informed sketches which provide indications of the trajectories these elements of the oil industry are likely follow over the coming decades.[59]

4.3a Historical Oil Prices

The annual prices of oil for the period 1861 to 2021 in fixed 2021 USD are illustrated below in Figure 4.4. Oil first became economically viable in 1859 (Hall and Klitgaard 2012, 147; Yergin 1991, 27). As such, this graph encompasses the pricing of oil across almost the entire lifespan of the industry. Unfortunately, data from 1859 to 1860, when the industry was in its infancy, are unavailable and thus those dates are excluded from this graph. Fixed 2021 USD have been utilised as the price markers because these provide a more useful basis for examining trends and comparing price increases over time than nominal prices. Unless otherwise stated, prices throughout are measured in barrels per day.

As Figure 4.4 illustrates, the first two decades of the oil industry were characterised by volatile prices. In 1864, prices peaked at an all-time high of $132.83; a level which has not been reached

[58] This is not a unique argument, however it does use the most up to date data and predictions from the leading primary sources including: the BP *Energy Outlook* (2022a; 2019); BP *Statistical Review of World Energy* (2022b); EIA *Annual Energy Outlook* (2021); IEA Key World Energy Statistics (2021); OPEC *Annual Statistical Bulletin* (2022); and OPEC *World Oil Outlook* (2021).

[59] Previous studies, including Meadows et al. (1972), have faced criticism due to the inaccuracy of predictions. Critics have then used these inaccuracies to disregard the premise of the studies' arguments (Bardi 2011). By presenting likely trajectories rather than definitive predictions, I aim to pre-emptively circumvent these critiques.

since (although 2011 prices came close at $125.88). This was followed by a steady decline which was interrupted by peaks in 1869, 1871, and 1877. This initial high then disrupted decline was likely the result of the industry developing, increased competition, further improvements to extraction techniques, opening up of new markets for the product, and the development of the Russian and Dutch oil industries (see Chapter 2).[60]

Following this early volatility, the price of oil remained relatively stable and affordable over the next 94 years from 1878 until 1972. During this period, prices fluctuated between $11.04 and $42.14. It was during this period that oil became increasingly utilised in the global political economy (as discussed in Section 4.2).

Both of the price spikes of the 1970s are highlighted in Figures 4.4 and 4.5. In 1973/4 the price of oil increased from $19.17 to $60.81. As discussed in Chapter 3, there is debate over whose interests prompted this increase; some argue that it was motivated by OPEC's new-found political economic power (Balaam 2014, 376; Campbell 1977, 90–97), others argue that it was orchestrated to benefit the USD and Western financial interests (Adelman 1972; Di Muzio 2015, 124, 150; Engdahl 2004, 130–38; Mitchell 2009, chap. 8; Oppenheim 1976; Shipley 2007, 9–10). Regardless of who prompted the spike, the outcome was a 217 percent increase. This spike was followed by another in 1979 where the price of oil increased to $112.69, rising again in 1980 to $115.68 (BP 2022b). This second spike coincided with the Iranian Revolution; however, the price increase itself was primarily a result of importing practices. At the time many countries purchased greater quantities of oil than they required for consumption in an attempt to provide a buffer against expected supply shortages (Hall and Klitgaard 2012, 213). The economic impacts of these shocks for oil-importing countries will be examined in Section 4.5.

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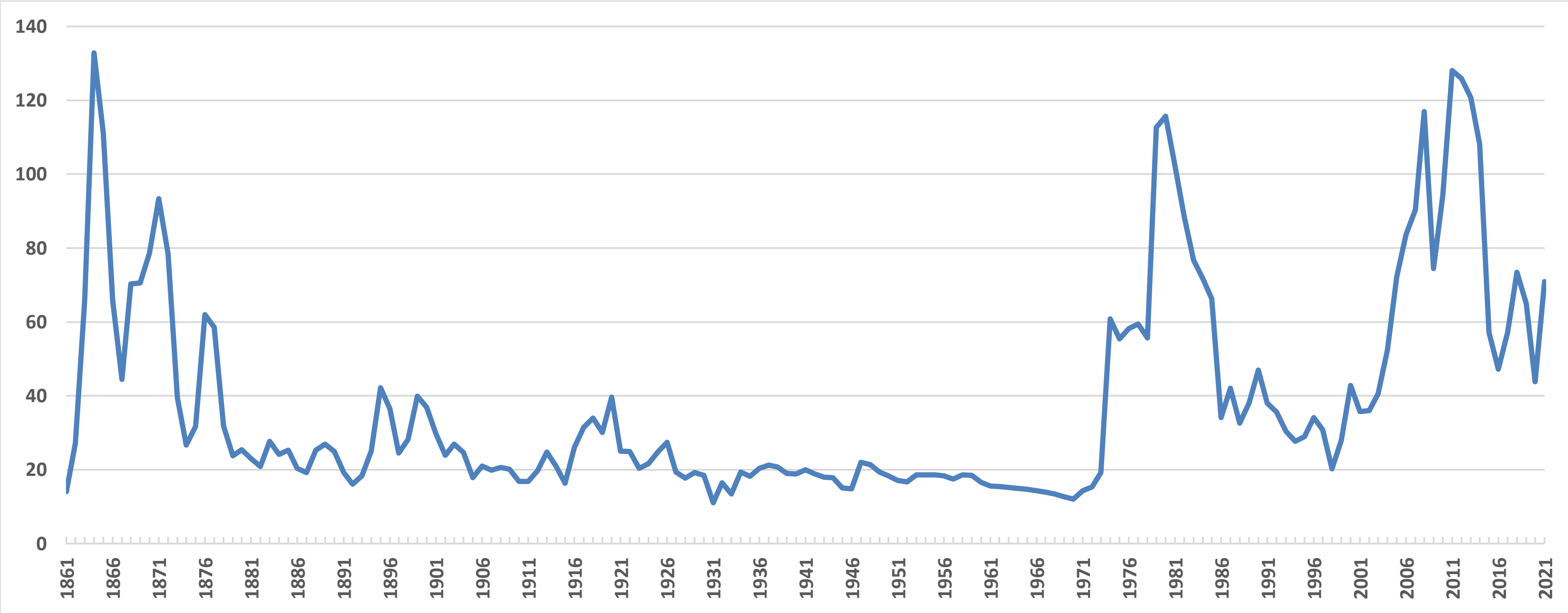
[60] For a thorough exploration of the first few decades of the oil industry see Yergin's *The Prize* (1991, chaps. 1–3).

Figure 4.4: Oil Prices 1861-2021 in fixed 2021 USD (per barrel)



Source: BP, Statistical Review of World Energy 2022.

Following the 1979/80 price spike, the price of oil took several years to stabilise. Between 1980 and 1985, the price steadily decreased from $115.68 to $66.29, before dropping sharply in 1986 to reach a low of $34.08. These decreases could be partially attributed to decreased global consumption following the 1979/80 price spike. Figure 4.6 illustrates a dip in global oil consumption from 1979 which continued until 1983. It was not until 1988 that consumption levels recovered to 1979 levels. In a market-economy, when all other factors are equal, the price of commodities is said to be determined by supply and demand. If, over the period 1970 to 1986, demand was decreased but available supply remained high, that would likely contribute to the decreased prices over this period.[61] While the demand for a product is determined by many factors (especially when looking globally), two key factors stand out in this instance. First, as a result of the 1970s price shocks, advancements were made in oil efficiency which temporarily decreased consumption (Alcott 2005).[62] Second, as mentioned above, many importing states responded to the Iranian Revolution by importing surplus oil to provide a buffer against an expected shortage. Thus, many states likely had a stockpile of oil which they could consume before needing to import more oil. These two factors would have contributed to this rapid decrease in price.

Over the following 13 years (1987-1999), the price of oil regained relative stability and traded in the range $20.19 to $46.98. During this period there were several small fluctuations, including a spike in 1990 which coincided with the Iraqi invasion of Kuwait (Noguera 2013, 66; Whipple 2010). However, from 1987 until 1999, the price of oil averaged approximately $33.33.

From the beginning of 1999, the price of oil began to rise sharply. It reached a peak of $116.91 in 2008, before contracting to $74.40 in 2009 during the Global Financial Crisis (GFC). The price increased over 2010, 2011, and 2012, reaching $125.88 in 2012, before settling at $120.72 in 2013. The price peaks and troughs from 1999 until 2014 were a result of multiple economic and political factors. First, between 1999 and 2008, the global economy was performing relatively well, at least in terms of GDP growth. Second, China and India greatly increased their oil consumption during this period (Noguera 2013, 66). Third, the US-led invasion of Iraq, beginning in 2003, contributed to increased prices, as did the ongoing ‘War on Terror’ by increasing risks to supply (see Chapter 3 for an exploration of oil price increases coinciding with war). In 2008, the

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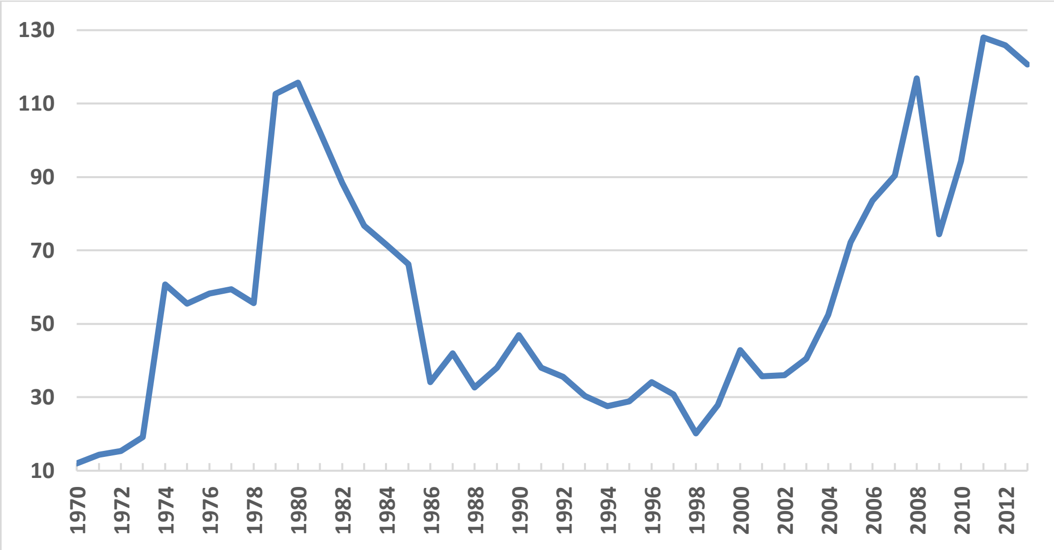
[61] Over this period, production decreased in line with consumption demand (see Figure 4.8), however this does not necessarily mean that capacity decreased, it simply means that a surplus was not produced.

[62] While the initial effect was decreased consumption, in line with Jevons’ paradox, increases in efficiency led to increased production and consumption rather than decreased (see Alcott 2005). Figure 4.6 illustrates that oil consumption has been steadily increasing since the 1970s.

price of oil reached a peak before dramatically decreasing when the GFC hit and the 'Great Recession' began. Late in 2008, OPEC reduced oil production (Whipple 2010, 5). This, combined with the slowly recovering global economy, saw prices rise again in 2010 (Noguera 2013, 66). Other disturbances within oil producing regions, such as the Arab Spring uprising, may have also contributed to the upward trend in prices observed over this period.

Figure 4.5: Oil Prices 1970-2013 in fixed 2021 USD (per barrel)



Source: BP, Statistical Review of World Energy 2022.

The dramatic increases and volatility experienced between 1999 and 2013 are reflective of the oil price spikes of the 1970s. Figure 4.5 provides oil prices from 1970 to 2013 to illustrate the similarities in trajectories. Prices between 2000 and 2012 had higher peaks than those experienced during the 1970s; reaching $128.01, compared to $115.68. Both datasets display similar overall increase over a similar time period. During the 1970s the price of oil increased by $103.69 over 11 years (1970-1980), and more recently, the price of oil increased by $92.29 over 11 years (2001-2011). Despite the similarities between these spikes, the more recent price increase has not received the same academic attention as the 1970s price spikes did. The implications of the 1970s spikes will be addressed in Section 4.5, however, one of the primary outcomes of oil price increases is that it results in larger trade bills for oil importers and a greater transfer of petrodollars to oil-exporters. Chapter 5 will illustrate the extent of these petrodollar transfers from both the 1970s and 2000s-2010s price spikes. Chapter 6 will explore the significance of these transfers as well as discuss how the petrodollars were, and are, recycled back into the global economy.

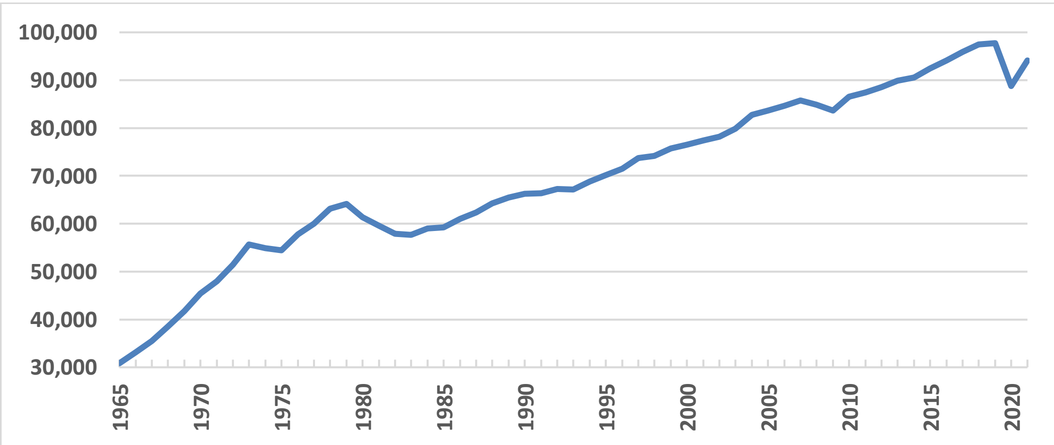
As shown in Figure 4.4, between 2013 and 2016, oil prices experienced a significant decrease, falling from $120.72 to $47.16. This decrease has been attributed to multiple factors. First, new sources of oil came on-stream. Higher oil prices enabled the development of oil fields which were in geographically unfavourable locations, as well as the extraction and production of unconventional oil reserves. While the production of these reserves was prohibitively expensive when oil was trading at a lower price, increased sale prices made the extra costs associated with these reserves feasible. For example, several discoveries were made in the Gulf of Mexico during this period (EIA 2019, 56; Rhodes 2017, 232). The addition of these new oil supplies contributed to overall decreased oil prices (Gould and McGlade 2019; Rhodes 2017, 238). Second, some OPEC states have recently been accused of producing at an exceptionally rapid rate and 'flooding' the market (Blas and Chilcote 2016; DiChristopher and Domm 2017; Raval 2015; Raval and Sheppard 2016; Rhodes 2017, 238; Smith 2015). The outcome of both factors has been increased supply which has facilitated decreased prices. The implications of these lower prices will be discussed in Section 4.4.

Since 2017, the oil market has been characterised by volatility. Over the period 2017 to 2021, prices have fluctuated every year, with the largest change occurring during 2020. The price of oil fell by almost one third in 2020, from $65 to $43.80, before recovering to $70.91 in 2021. This decrease is likely in response to the global COVID-19 pandemic which saw industries dramatically decrease output (both production and service output). This would have decreased demand for oil (as illustrated in Figure 4.6), and likely resulted in a temporary plummet in prices.

4.3b Oil Consumption

Global oil consumption rates have continued to grow steadily over the past five decades. Figure 4.6 illustrates oil consumption from 1965 to 2021. In 1965, global consumption was 30,839 thousand barrels per day. In 2021, consumption reached 94,088 thousand barrels per day. This represents a total increase of approximately 205 percent in 57 years, or an average of just under 3.6 percent annually (BP 2022b).

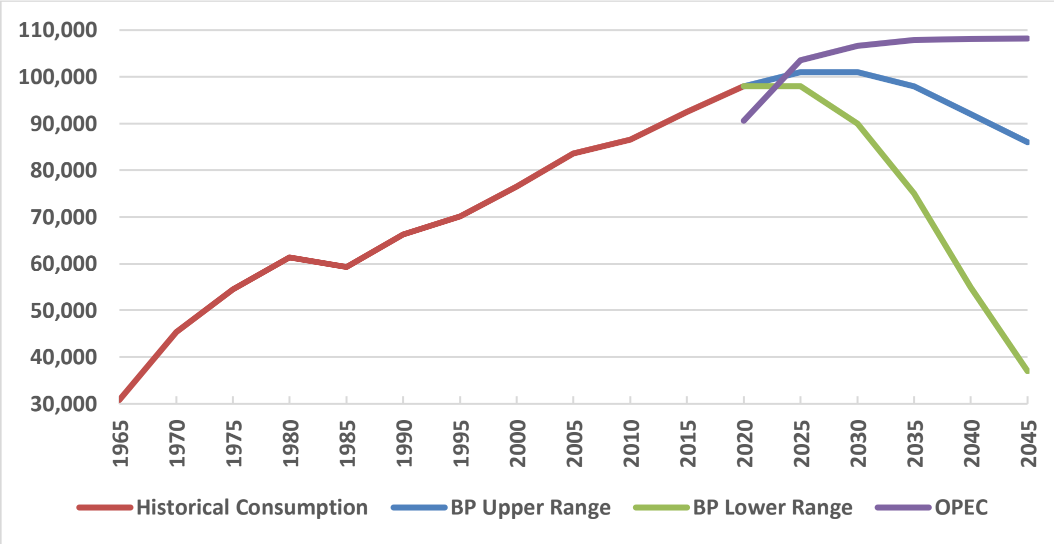
Figure 4.6: Global Oil Consumption 1965-2021 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022.

Future oil consumption is a contested topic and the main industry leaders envisage vastly different trends for the next few decades. Figure 4.7 illustrates oil consumption from 1965 until 2020, and then three predictions for oil consumption from 2020 until 2045: BP's (upper range), BP's (lower range), and OPEC's. These data are presented for every five years to remove annual fluctuations.

Figure 4.7: Global Oil Consumption 1965-2045 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022; BP, Energy Outlook, 2022; OPEC, World Oil Outlook, 2021.

In their *Energy Outlook*, BP (2022a) predicts future oil consumption based on several possible scenarios, all of which represent a decline on current consumption. They speculate that in 2045, global oil consumption will range between 86,000 thousand barrels per day and 37,000 thousand barrels per day (BP 2022a). The first figure (86,000 thousand barrels per day) represents a decrease back to 2010 levels of consumption. The second (37,000 thousand barrels per day) would result in a reduction to figures not seen since 1967. The predicted decline is expected to result from a generalised transition away from oil across various sectors of the economy. However, BP (2022a) expects that the primary impact will stem from a growing transition to electric road vehicles. This assumption is in direct contradiction to analyses by EIA, IEA, and OPEC who all posit that oil consumption in the road transportation sector will increase over the next few decades (EIA 2021; IEA 2018, 79; OPEC 2021).[63] BP's oil consumption projections from 2022 are also in stark contrast to the predictions they made just three years earlier in their 2019 *Energy Outlook*. In 2019, BP (2019, 44–45) predicted that global oil consumption would range between 130,000

[63] See Section 4.4c for an exploration of the ability of non-oil energy to replace oil in the transportation sector.

thousand barrels per day and 80,000 thousand barrels per day. The lower of these two figures would represent a decline in consumption, and the higher would represent a near 33 percent increase on 2020 consumption rates. These projections represent a vastly different image than BP's 2022 projections.

BP's 2019 projections align closely with the trendlines presented by the IEA. The IEA (2021) speculated that by 2040, global oil consumption will either increase by 32 percent, or decrease by 18 percent. Their higher projection is based on the continued implementation of current energy policies and announced future energy policy. Their lower projection is based on approaches to achieve internationally agreed objectives relating to energy, air quality, and climate change.

OPEC differs from IEA and BP in that it presents only one projection. OPEC (2021, tbl. 3.2) speculates that oil consumption will increase by approximately eight percent between 2019 and 2045, reaching a high of 108,200 thousand barrels per day. This scenario reflects a slower increase than that which has been experienced over the past five decades. However, it still suggests that demand will continue to increase moving forward. OPEC further speculates that oil will remain the primary global energy source through to 2045 (OPEC 2021, 1).

This thesis will not presume to surmise definitive quantities of future oil consumption. However, it will rely upon the more prevalent assumption that oil consumption will either decrease slightly (while remaining historically high), or increase over the next few decades (BP 2019; IEA 2018, 79; OPEC 2021). While we cannot discount BP's most recent projections which indicate a severe reduction in oil consumption primarily resulting from the rising prevalence of electric vehicles, the majority of industry leaders do not support this claim (EIA 2021; IEA 2018, 79; OPEC 2021).

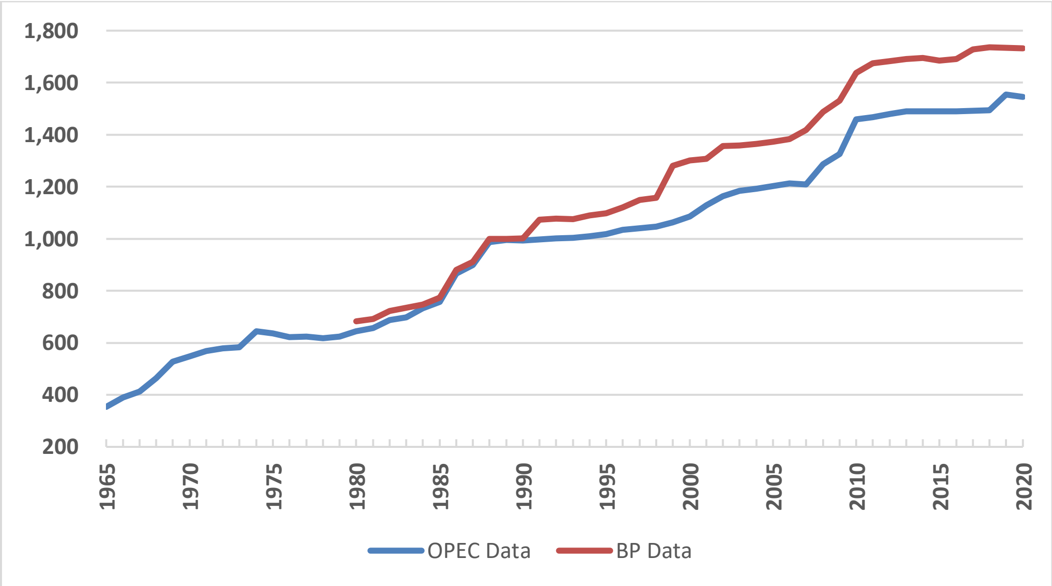
As a non-renewable resource, oil reserves cannot be replenished on a human timeframe. Thus, continued consumption will deplete reserves. If depletion occurs faster than new accessible reserves are discovered and developed, or technological advancements in extraction are made, demand will eventually outstrip supply. If everything else is equal, in a market-economy when demand is greater than supply, the price of a commodity increases. This is the likely trajectory of oil prices over the next few decades given that it is a non-renewable substance. This idea will be explored further in Section 4.3d.

4.3c Oil Reserves

As outlined in Chapter 2, it can prove problematic to obtain accurate oil reserves data. In some states, oil reserves data are considered to be a state secret, and for this reason their data are not always verified by an independent party (Clark 2005a, 80–81; Tsoskounoglou, Ayerides, and Tritopoulou 2008, 3081). In addition, oil-producing states have historically manipulated their reserves data to portray inflated figures (Clark 2005a, 80–81). Bearing those challenges in mind, the data in Figure 4.8 are gathered from the two most reliable sources; the BP *Statistical Review of World Energy* (2022b), and the OPEC *Annual Statistical Bulletin* (2022). Both datasets have been used for this graph as BP's dataset does not encompass the desired period of 1965-1980 while OPEC's dataset does.[64]

As illustrated in Figure 4.8, the data collected by OPEC on proven reserves have deviated lower than BP's data since 1990. This is predominantly accounted for by discrepancies in the reporting of reserves in Canada and the US. The OPEC *Annual Statistical Bulletin* (2022) expressly states that it does not include oil sands in their reporting for Canada. And while they have not included qualifiers on their figures for the US, it is a logical assumption (given the discrepancy in figures for the US between the two datasets) that they do not include the US' unconventional reserves.

Figure 4.8: Global Proven Oil Reserves 1965-2020 (billion barrels)



Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin,2022, tbl. 3.1.

When discussing proven reserves data, this thesis will predominantly rely upon BP's dataset. I agree that unconventional oil is more expensive and energy intensive to produce than conventional oil, and that it is not a long-term solution to the depletion of conventional oil (see Section 4.4). However, unconventional oil is still a usable energy source (so long as it remains financially

[64] The other key oil indicators in this chapter – consumption (Figure 4.7) and production (Figure 4.9) – extend back to 1965. For continuity, proven reserves should also extend back to 1965.

viable) and for that reason it should be considered in a discussion on available reserves.

As illustrated in Figure 4.8, global proven oil reserves steadily increased from 1980 until 2010. Over this period, they increased from 682.6 billion barrels to 1,636.9 billion barrels; an average annual increase of 4.5 percent. However, since 2010, global proven oil reserves have remained relatively stagnant, fluctuating between 1,636.9 billion barrels and 1,736.1 billion barrels (BP 2022b). This indicates that no *significant* new proven reserves have come on stream over the 10 years between 2010 and 2020. Although enough discoveries have been made to replace the oil consumed over this period.

The reduced rate of new discoveries becomes increasingly significant when we consider proven reserves rates with consumption rates. BP (2022b) reported that in 2020, global proven reserves equalled 1,732.37 billion barrels. In that same year, global oil consumption rates equalled 32.48 billion barrels. The reserves to consumption ratio demonstrates that existing proven reserves account for less than 54 more years of 2020 consumption rates.[65] As outlined in Section 4.3b, future consumption rates are unknown and contested. In addition, as will be outlined below, it is not feasible to extract all the oil from a reserve. Furthermore, we cannot definitively say that there will be no more significant oil discoveries. For these reasons, it is not as simple as to say that the world will run out of oil in less than 54 years. Rather, what these figures show is that current proven reserves do not include much of a buffer at current consumption rates.

4.3d Peak Oil

In the coming decades, it is likely that the peak production of conventional oil will be a significant factor which ensures that the price of oil continues to rise. As discussed in Chapter 1, peak oil is based upon Hubbert’s (1956) proposal that the production of oil (or any non-renewable substance) follows a bell-shaped curve. Production increases after discovery then reaches a peak once half of the resource has been extracted. Following this peak, production declines until it is no longer feasible to extract any more of the resource. The feasibility is based upon financial costs as well as the ratio of energy extracted to energy required for extraction (this ratio is referred to as energy return on energy invested (EROEI)). Importantly, peak oil refers to production rates rather than oil reserves. Peak is reached once half of a reserve has been extracted, and production will likely cease when it is no longer viable in terms of energy or economic factors. There will likely still be significant reserves remaining in the earth when peak production is reached, it will just become

[65] This is figure is calculated by dividing total proven reserves by the annual rate of consumption. The annual consumption rate is calculated by multiplying daily consumption by the number of days per year (365.25 to account for leap years).

less feasible to extract the remaining reserves (Bardi 2009, 323; Deffeyes 2001; Pfeiffer 2006; Rhodes 2017).

The first application of Hubbert's model was to the expected production of US domestic oil. Hubbert predicted that US production would peak in the early 1970s and conventional US oil production did indeed peak in 1971. Hubbert's model has since been applied to global oil production to generate estimated dates of peak global production (Deffeyes 2001, 1–4).

There is currently no definitive consensus on the expected date of global peak oil. Future production rates are estimated based upon reported oil reserves coupled with factors such as technology and the geology of each oil-field (Hirsch, Bezdek, and Wendling 2005, 12). As previously mentioned, reserves data are often problematic due to occurrences of over-reporting and difficulties associated with verifying (Clark 2005a, 80–81; Pfeiffer 2006, 32; Tsoskounoglou, Ayerides, and Tritopoulou 2008, 3801). Falsified and inflated statistics have caused estimations of peak oil to vary significantly. In 2005, the US Department of Energy commissioned a report which outlines the potential impacts as well as the possibility for mitigation and risk management of peak conventional oil. This report, commonly known as the 'Hirsch Report' after its principal author, highlighted peak oil projections from a range of 12 different sources. While one source claimed that there was no visible peak to predict, the other 11 predicted that conventional oil production would peak during the period 2006-2025 (Hirsch, Bezdek, and Wendling 2005, 19).

Without mitigating action, the peaking of oil production is likely to have severe ramifications for oil prices. If oil consumption rates remain at current levels or continue to rise, any stagnation or reduction in production will likely lead to increased prices. If demand remains high while supply decreases, the price will escalate. Any attempt to predict the severity or speed of such an increase is beyond the scope of this thesis as too many variable factors would require examination.[66] In its *Annual Energy Outlook*, the EIA (2022, 3) speculates that the price of oil will reach anywhere between $45 and $170 in 2050 (in fixed 2021 USD). However, given that oil is a non-renewable resource, once peak production is hit, it could be assumed with relative certainty that the only method to bring supply and demand into alignment once more would be to decrease demand to match supply.[67] As discussed above, there is some discrepancy in projected future oil consumption

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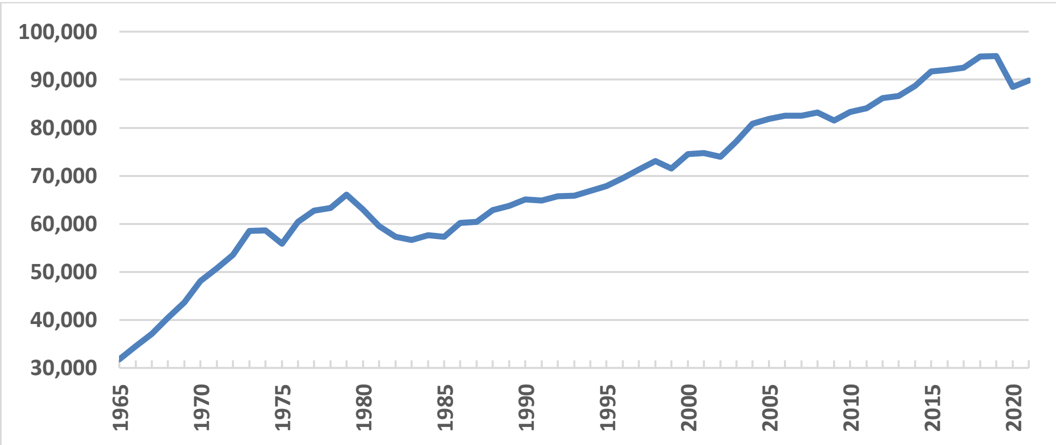
[66] Some of these variables include (but are not limited to): projected production and discoveries, international markets, future conflicts, economic growth, the business cycle, improvements to alternative energy technology, increased energy efficiency, pressures resulting from climate change, fossil fuel divestment, and stranded assets.

[67] See Friedrichs' (2010) article *Global Energy Crunch* for an analysis of likely country-based reactions to decreased oil availability.

rates, however the most prevalent projections are that oil consumption is likely to either decrease slightly (while still remaining historically high) or even increase (BP 2019; IEA 2021; OPEC 2021). If this is the case, and demand cannot be reduced in accordance with supply, the price will likely continue to rise.

While nine of the 12 projections included in the Hirsch Report (2005) speculate that production would have peaked on or before 2020, global oil production figures suggest that peak may not yet have occurred, likely due in part to the harnessing of unconventional oil sources. Figure 4.9 illustrates global oil production rates from 1965 to 2021. Over these 57 years there have been a few dips in production, the most notable of which occurred from 1979 to 1983, however, as a general trend production has increased by a total of 182.7 percent over this 57 year period. The production increase was only moderate over the period 2015 to 2019, before it fell sharply to 88,494 thousand barrels per day in 2020. In 2021, production appears to have commenced recovery; increasing by nearly 1.4 million barrels per day on 2020 figures (BP 2022b). The fluctuations over the last few years could indicate that peak production is nearing, however they are more likely a result of economic contractions from COVID-19 and reduced global demand for oil in 2020.

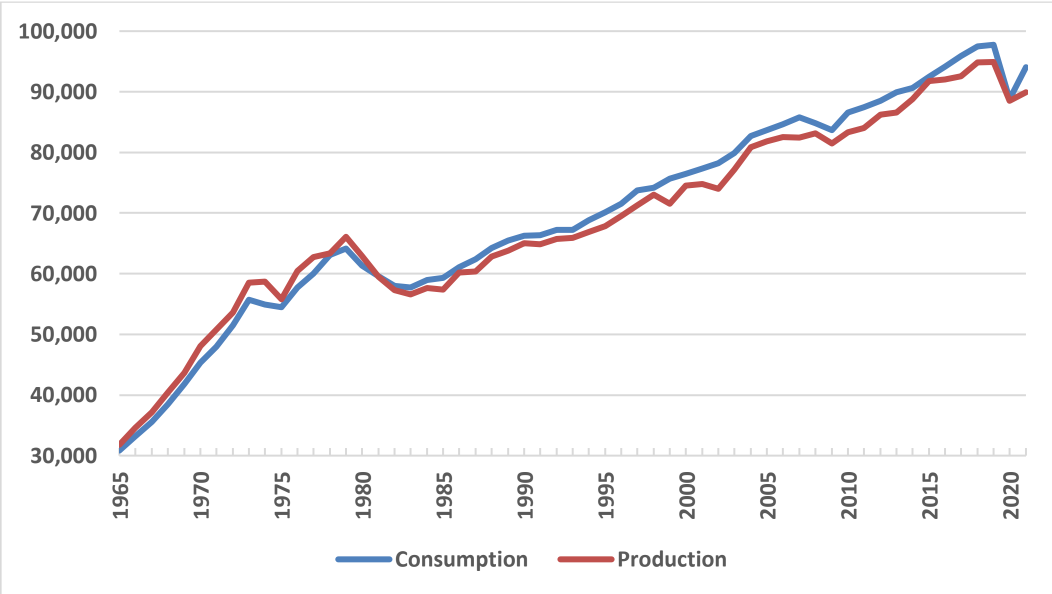
Figure 4.9: Global Oil Production 1965-2021 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022.

Two factors which may impact on the visibility of peak must be considered. First, while the trendline of Hubbert's Peak is a bell-shaped curve, production rates will fluctuate on an annual basis which will result in fluctuations along the bell-curve. As such, we will not know definitively that peak production has occurred until several years after the fact when there is a visible continued trendline. Second, there is potential for oil producing countries to manipulate production rates. All things being equal, oil production would likely slow as it becomes less profitable or even unprofitable. However, there is the potential, especially among big producers, to temporarily maintain high production rates despite decreased profitability. As an example, over recent years it has been suggested that key OPEC producers are overproducing. Towards the middle of the 2010s, Saudi Arabia was accused of overproducing (Blas and Chilcote 2016; Raval 2015; Raval and Sheppard 2016; Smith 2015), and in 2017, it was suggested that Iraq was producing in excess of their quotas (DiChristopher and Domm 2017; Rhodes 2017, 238). Examining the production rates for OPEC producers it is evident that Saudi Arabia's production rates did balloon slightly between 2010 and 2020, with the highest peak being in 2016. Iraqi production also increased from 2010, although its production declined between 2019 and 2020 (BP 2022b). If it was the case that these states were overproducing, it would obscure the appearance of peak as production rates may not decrease in the smooth, downward bell-shaped trajectory that analysts would expect. In fact, if overproduction delayed the appearance of a peak, the result may be a more dramatic decline as early depletion would have been concealed.

Figure 4.10: Global Oil Production and Consumption 1965-2021 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022.

The pace of decline is of crucial importance to future oil prices. As previously established, as a non-renewable resource, depletion and the ensuing decreased production will likely result in a prolonged increase in price unless demand is simultaneously reduced. As is illustrated in Figure 4.10, consumption and production follow near identical trendlines.[68] This is to be expected

[68] Discrepancies between the production and consumption datasets are accounted for by BP (2018, 15) as resulting from "stock changes, consumption of non-petroleum additives and substitute

as producing surplus to requirements would generally not be in the economic interests of the producers (with the exception of the recent overproduction discussed above).[69] However, these close trendlines mean that there is little margin for error. If production were to follow Hubbert's bell-shape, any decline in production would be a relatively smooth process where production would gradually become more energy and financially intensive, and the increased costs would be passed on to the consumer, resulting in a relatively gradual increase in price. However, if present production values are being influenced by unsustainable over-production in a way that obscures the appearance of peak oil, this could mean that the decline in production characterised by increased financial and energy input would be more rapid and severe. If this were the case, consumers could simultaneously experience dramatically decreased availability which would increase prices (assuming demand was not immediately decreased) as well as *additional* price increases as production costs were passed on by the producers. This is not to say that hardships would not be experienced if oil production were to follow the shape of Hubbert's curve, simply to say that if production is manipulated in a manner to obscure peak, the hardships are likely to be even more dramatic and severe.

4.3e Summary

In this section, I argued that while the price of oil may currently be low compared to the high prices experienced between 2005 and 2014, it is unlikely to remain low moving into the future. By tracking oil consumption trends from 1965 and using industry leaders' projections for oil consumption over the next two decades, I argued that consumption levels have been steadily increasing for 57 years and could continue to increase, moving into the future. When this is considered in conjunction with the non-renewable nature of oil, coupled with the fact that the rate of new reserve discoveries has decreased significantly since 2010, I argue that as the resource becomes increasingly depleted the price of oil is likely to increase. I do not attempt to speculate on the projected future price of oil, as doing so with any degree of accuracy would require the consideration of too many variables and falls outside the scope of this thesis. However, I do identify that the rate of price increase could be influenced by current rates of production. It has been suggested that the current production rates of some OPEC states are unsustainably high. If this is the case, then the peaking of oil production may be obscured, and the ensuing side effects

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fuels, and unavoidable disparities in the definition, measurement or conversion of oil supply and demand data."

[69] Producing a surplus could lead to decreased prices as global supply would be greater than demand. This is unlikely to be economically appealing to producers. Alternatively, if a surplus was produced it could be stored by producers rather than being put on the market, however this would not be a practical or ideal outcome.

(decreased supply and increased prices) may be more severe as a result.

4.4 Oil Alternatives

Two main critiques are levelled at the peak oil hypothesis. First, that the predictions have not been met (Bardi 2019). Second, that the theory does not account for the ability of the market to resolve issues relating to shortages (Hall 2016). The first represents an oversimplified manner of evaluating the peak oil hypothesis. The failed accuracy of certain predictions does not necessarily represent a defunct theory. It may simply represent the addition of new data. The discovery of new reserves (including unconventional oil), changes in production rates, price fluctuations (which can alter both the previous indicators), and many other factors can all alter the point of peak production. While predicted dates may prove to be inaccurate, that does not demonstrate the inaccuracy of the theory itself given the non-renewable nature of oil. The second critique is based upon one of neoclassical economics' foundational principles: price signals guiding the self-regulating market. In this section, I refute this critique. First, I highlight market manipulation as the prime limitation of price signals to prompt the transition away from oil consumption. Second, I explore the role of unconventional oil in mitigating peak oil. Following this, I explore the potential for alternatives to replace oil in two key sectors of the economy: transportation and petrochemicals which collectively comprise 70.8 percent of oil consumption (OPEC 2018, 125). I argue that oil consumption in these sectors is unlikely to decrease as alternative options are not currently viable and are unlikely to become so over the next two decades. Ultimately, this section posits that while improvements have been made in both unconventional oil and alternative options, they do not currently represent feasible long-term solutions sufficient to definitively prevent higher oil prices and resultant economic shocks.

4.4a The Limitation of Price Signals to Prompt a Transition

While market signals are excellent in theory (and may be effective in some instances),[70] in our current economic system, powerful producers have the ability to manipulate production in order to set prices, and this undermines the notion of accurate price signals. Veblen (1904/1965) refers to this process as sabotage whereby the purpose of business is to sabotage or control production in order to influence prices. This may be occurring in the case of current oil production as was discussed in Section 4.3 (Blas and Chilcote 2016; DiChristopher and Domm 2017; Raval 2015;

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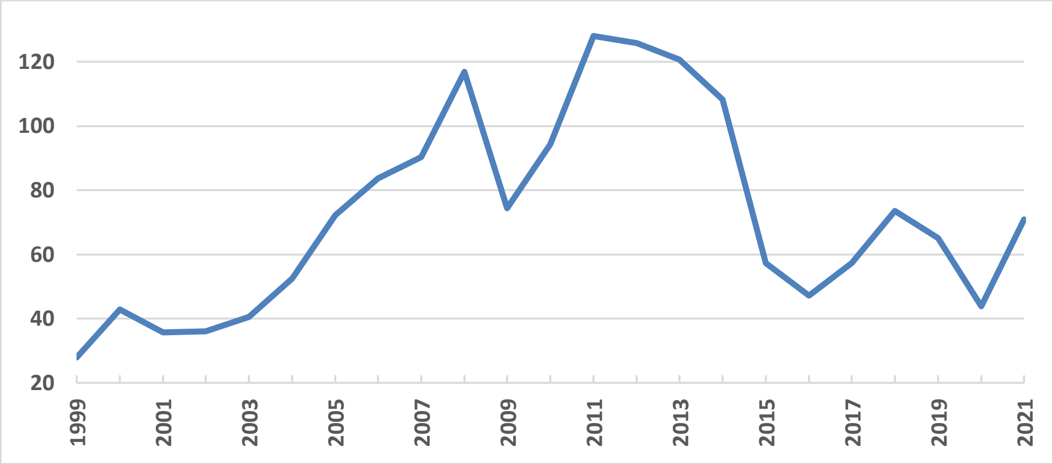
[70] The development of the unconventional oil industry provides an example of price signals prompting investment in, and development, of alternatives. When the price of conventional oil reached a certain height, it made the production of geographically challenging and unconventional oil fields feasible (EIA 2019, 56; Rhodes 2017, 232).

Rhodes 2017, 235; Raval and Sheppard 2016; Smith 2015).

Figure 4.11: Oil Prices 1999-2021 in fixed 2021 USD (per barrel)



Source: BP, Statistical Review of World Energy 2022.

As is illustrated in Figure 4.11, after dramatic peaks in 2008 and 2011, the price of oil remained above $120 until after 2013. After this time, the price plummeted to $47.16 in 2016, before recovering slightly at $73.50 in 2018 to just under 2009 prices. There was another sharp drop in 2020, before prices settled again at $70.91 in 2021. While prices have been lower over the seven years 2015 to 2021 compared to the rapid peaks of the mid-2000s to mid-2010s, this is not a signal that there is adequate global oil supply and that oil prices will continue to decrease. Within a market-economy, when all other factors are equal, decreased price tends to reflect sufficient supply. However, these recent reductions in oil price are due two main factors. First, several oil-producers have increased production with the intention of driving prices down and pricing competitors out of the market (Blas and Chilcote 2016; DiChristopher and Domm 2017; Raval 2015; Raval and Sheppard 2016; Rhodes 2017, 238; Smith 2015).[71] Second, lower prices have made unconventional oil more economically viable, and the market is being flooded with increased supply which also pushes prices down (EIA 2014; Raval 2018; Rhodes 2017, 238). These lowered prices are likely to be temporary.

Decreased prices may in fact result in greater consumption and thus oil becoming depleted at a faster rate. This phenomenon where lower prices encourage increased consumption is in line with Jevons' paradox. Jevons identified that increases in efficiency tend to lead to increased production and consumption rather than decreased. The paradox is that as efficiency improves, decreased

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[71] Prices also fell in 2020 in line with economic contraction coinciding with the COVID-19 global pandemic.

prices often ensue, and rather than consumption rates stagnating at the lower prices, consumption tends to climb. While Jevons was hypothesising and tracking coal production, other academics have since applied his theory to the production of other non-renewable resources including oil (Alcott 2005).

Lower prices may also be removing incentives to invest in alternative energy sources. When large producers have the ability to manipulate production to alter prices, market signals become less reliable. As such, investments spurred by prices should not be relied upon as a sole mitigation tool.

4.4b Unconventional Oil

Unconventional oil refers to oil which cannot be extracted using the same methods as conventional oil. Conventional oil is extracted by drilling into a reservoir and allowing the oil to flow into the formed hole. Unconventional oil, however, has formed in a way to make extraction via vertical drilling impossible. Shale oil, for example, is oil which has formed either too close to the earth’s surface or has developed for an insufficient period of time. As such, it forms within rock formations rather than as a single large reservoir. The oil which is present in tar sands occurs when oil is formed without the presence of a hard crust on top of the reservoir. This allows the tar to seep towards the earth’s surface and mix with the sands rather than remaining unspoiled within the reservoir. Shale is often extracted using hydraulic fracturing, and tar sands are predominantly produced with mechanised equipment such as shovels or excavators (EIA n.d.; n.d.; Rogner 2000, 140; Rosa and D’Odorico 2019, 744).

The development of unconventional oil has boosted reserves and production rates over the last decade. US Shale production has increased dramatically over the last eight years, increasing from approximately half a million barrels per day in 2010, to approximately 8.5 million barrels per day in 2019 (EIA 2020a, 29). However, oil produced from these unconventional sources by unconventional means is not a feasible long-term solution to depleting reserves for three main reasons. First, the production process to derive oil from both shale and tar sands is energy intensive, more so than conventional oil. This results in a lower EROEI than conventional oil, meaning that a larger portion of the energy produced must be utilised to extract more energy (Heinberg 2009, 23–25, 51–52; Rhodes 2017, 231–35). Second, its production requires the use of large quantities of other resources and its combustion is more environmentally harmful than conventional oil (Elhefnawy 2008, 41; Heinberg 2009, 52; Rhodes 2017, 232; Rogner 2000, 142; Rosa and D’Odorico 2019; Urry 2012, 573). Third, and most importantly, it remains a non-renewable resource and is therefore exhaustible. At best, procuring oil from unconventional sources can only delay the impacts of peak oil. While unconventional oil might allow the age of high oil-fuelled consumption to continue marginally longer, it is a costly and ultimately unsustainable option, particularly in light of concerns over climate change.

4.4c Alternatives in Transportation and Petrochemical Sectors

When looking at oil alternatives, the replacement of oil in some sectors is more problematic than in others. For example, at present only 5.4 percent of oil is consumed in the production of electricity (OPEC 2021, tbl. 3.3). Electricity can be generated from many different resources, and therefore it seems feasible that oil could be replaced in this sector. Indeed, this is the only sector in which increased oil consumption is not projected over the next 25 years (see Table 4.1). OPEC (2021, tbl. 3.3) predicts that oil consumption for electricity generation will decrease from 4.9 million barrels per day in 2020 to 3.9 million barrels per day in 2045. However, the replacement of oil in other sectors may prove more problematic, or even unfeasible as some require the unique characteristics of oil. Two of these sectors will be discussed below: transportation, and petrochemicals. As Table 4.1 illustrates, these two sectors consume the greatest portions of oil (representing 54.2 percent and 14.3 percent of total oil consumption respectively), and their share of oil consumption is expected to further increase by 2045 (representing 57.5 percent and 16 percent respectively) (OPEC 2021, tbl. 3.3). This is not to say that other industry and residential/commercial/agriculture consumption are inconsequential,[72] simply that as the largest contributing sectors, transportation and petrochemicals are the most vital at present.

Table 4.1: Oil Demand by Sector 2020 and 2045

	2020 million barrels per day	2020 percentage of total	2045 million barrels per day	2045 percentage of total
Transportation	49.2	54.2	62.2	57.5
Petrochemicals	13.0	14.3	17.3	16.0
Other Industry	12.7	14.0	13.3	12.3
Residential/Commercial/ Agriculture	10.9	12.0	11.6	10.7
Electricity Generation	4.9	5.4	3.9	3.6
TOTAL	**90.7**	**100**	**108.2**	**100**

Source: OPEC, World Oil Outlook, 2021, tbl. 3.3.

Transportation

The importance of transportation to the functioning of our global economic system, which is premised on specialisation and long-distance trade, was outlined in Section 4.2. As such, any discussion on the viability of oil alternatives must address their applicability to the transportation

[72] Indeed, the importance of oil in agriculture and the likely implications of disrupted oil supply were outlined in Section 4.2c.

sector. In 2020, transportation accounted for 54.2 percent of total global oil consumption. Approximately 91.3 percent of the total energy consumed in the transportation sector in 2019 was derived from oil (IEA 2021, 47; OPEC 2021, tbl. 3.3).[73]

Road transportation consumes the greatest quantity of oil. In 2020, road transport represented 44 percent of total oil consumption (OPEC 2021, tbl. 3.3). Within this sector, vast technological improvements have been made to provide alternative power options. Longer lasting and more affordable batteries have resulted in the increased infiltration of electric vehicles into the market. This has been assisted by several state-implemented policies to encourage the production and purchasing of electric-powered vehicles (Hirst 2019; IEA n.d.; Nikel 2019; OPEC 2021, 113, 115). However, despite the fact that electric vehicles have become more prolific, in 2017 they still only comprised 1.3 percent of all global passenger car sales (OPEC 2018, 131). This figure is expected to increase over the next two decades, with OPEC (2021, 117–18) predicting it to rise to 20 percent by 2045. This global trend projection is replicated by the EIA's assessment of future vehicles sales in the US. The EIA (2021, 24) predicts that oil-powered, light-duty vehicles will continue to dominate the US sales market over the next few decades. They project that in 2050, electric vehicles will likely account for approximately 29 percent of all US car sales.[74] Despite a projected higher ratio of electric to oil-powered vehicles, total car sales are expected to increase to a degree that the total quantity of oil-powered cars will offset any progress through increased sales of electric vehicles. Overall, oil demand in road transportation is expected to increase over the next few decades. It is predicted to increase from 40 million barrels per day to 46.2 million barrels per day between 2020 and 2045, and motor gasoline will likely remain "the major transportation fuel through 2050" (IEA 2018, 79; OPEC 2021, tbl. 3.3).[75] This indicates that despite improvements in electrification, the vast majority of car sales will continue to be conventionally oil-powered, and total oil consumption for the sector will increase over the next few decades (EIA 2021; OPEC 2021).

Similarly to road transportation, technological advancements are being made in both aviation and marine transportation. There has been increased pressure to improve energy efficiency, both from

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[73] It would be ideal to have data on the contribution of oil to the transportation sector and the amount of oil consumed by transportation for the same year. However, these figures are the most recently available, and having the data for two consecutive years is sufficient to indicatively demonstrate the crucial nature of oil to transportation.

[74] Oil-powered vehicles included in these data represent those powered by gasoline, flex fuel, and diesel (EIA 2021, 24).

[75] These figures are based on OPEC's estimates.

policy decisions, and from necessity stemming from fuel prices. In addition, there has been increased exploration into electrification and, in the case of marine transport, the application of natural gas and nuclear capabilities. While OPEC (2021, 125) speculates that small electric aircraft may become commercially viable in the short-term, they claim that electric aircraft are unlikely to significantly substitute oil demand through 2045. Furthermore, overall increased demand is expected to outweigh the increased efficiency and alternative fuelling options, and the demand for oil in both aviation and marine transportation is expected to increase (OPEC 2021). Overall, both OPEC and the IEA predict that oil consumption in transportation will increase, and transportation will continue to represent the majority of oil consumption through to at least 2045 (IEA 2018; OPEC 2021).

It is also important to note that electricity is still primarily generated with fossil fuel energy; 61.5 percent (BP 2022b).[76] As such, without advances in renewable energies to reduce reliance on fossil fuels for electricity generation, a transition from oil-powered transportation to electrified transportation may only be a temporary fix until other fossil fuels become depleted or carbon emissions become too high.

The implementation of biofuels, specifically ethanol into the transportation sector has been quite successful. A mixture of ethanol and oil can be used to fuel most automobiles. However, its corrosive nature impedes its ability to replace conventional oil. At present, the highest ratio that has proved commercially successful is one part ethanol to ten parts oil (1:10). A higher ratio would require the modification of existing engines as well as the upgrading of existing oil infrastructure such as pipelines (Heinberg 2009, 47–48; OPEC 2018, 175). Ethanol production is also problematic as it is resource intensive – using large quantities of land, water, and fossil fuel input. In addition, it is produced from a crop which is typically a food source. While this is not problematic in and of itself, it has sparked a debate on the ethics surrounding utilising food crops for oil production (Heinberg 2009, 17,48; Koizumi 2015; Trainer 2007, 90; UN 2007; Zehner

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[76] In 2021, 36 percent of global electricity was generated from coal, 23 percent came from natural gas, and 2.5 percent from oil. The remaining 38.5 percent of electricity was generated from nuclear energy (9.8 percent), hydroelectricity (15 percent), renewables (12.8 percent), and other sources
(0.9 percent) (BP 2022b).

2012, 80).[77] For these reasons, biofuels are not presently a viable complete alternative to oil in the transportation sector, although their utilisation in the short-term may allow greater time for a transition away from oil.

Petrochemicals

Oil may prove to be even more difficult to replace within the petrochemicals sector. As outlined in Section 4.2, petrochemicals are used in the production of many products which have become integrated into modern life including such things as plastics, medicines, and synthetic materials (American Fuel & Petrochemical Manufacturers n.d.; IEA 2018). Their replacement with alternatives is challenging on two fronts. First, they are derived directly from oil and therefore each chemical would require the discovery and development of a new source material. Second, these chemicals have become so integrated into our modern lifestyles that any alternative would need to be produced in large quantities in order to satisfy current and projected increased future demand. As an example, the IEA (2018, 72) speculates that the demand for petrochemicals required to create plastic could increase by almost 70 percent by 2050. They note that consumption may be affected by increased recycling initiatives and therefore reduced wasteful consumption. However, Birol, the executive director of the IEA, predicts that "[recycling] efforts will be far outweighed by developing economies sharply increasing their shares of plastic consumption (as well as its disposal)" (Birol n.d.; IEA 2018). There have also been developments in biologically derived and biodegradable petrochemical alternatives (Patel 2015; Savage 2016; Song et al. 2009; Yaradoddi et al. 2016). Yet, despite this, petrochemical demand is projected to increase by 4.3 million barrels per day between 2020 and 2045 (OPEC 2021, tbl. 3.3). This indicates that while progress is being made regarding petrochemical alternatives, petroleum derived petrochemicals are still expected to meet the majority of demand in this growing sector.

In Section 4.2, I outlined the crucial importance of oil in a large-scale transnational agricultural system. Oil is required for irrigation, large machinery, refrigeration, and transportation. It also requires petrochemicals for pesticides, fertilisers, and packaging (Campbell 1977, 196; Hall and Klitgaard 2012; Heinberg 2005, 193; Pfeiffer 2006; Pimentel and Pimentel 2008; Rhodes 2017, 233). With a rising population, and the likelihood that oil consumption is expected to rise within the transportation and petrochemical sectors, there will likely be dire implications for global food in/security.

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[77] Currently 842 million people are categorised by the Food and Agriculture Organization of the United Nations (FAO n.d.) as living in chronic hunger, and the use of agriculture crops for biofuels could result in increased food prices which could further exacerbate this issue (Heinberg 2009, 17,48; Koizumi 2015; Trainer 2007, 90; UN 2007; Zehner 2012, 80).

4.4d Summary

In this section, I addressed one of the major critiques charged at the peak oil hypothesis: that it disregards the ability of the market to mitigate the impact of shortages. First, I demonstrated the limitations of the market to signal a transition to alternative energy sources. In our existing economic system, large producers have the ability to manipulate production and therefore prices in a manner which can obscure the visibility of potential future shortages. If prices are manipulated, then price signals have limited potential to be effective. Following on from this, I explored the role of unconventional oil within the oil industry and demonstrated that it may provide a temporary boost in supply, however it is not a long-term solution to approaching peak. Finally, I identified the transportation and petrochemicals sectors as the main consumers of oil and argued that there are presently no alternatives which could replace oil to a sufficient degree within the next few decades to prevent the hardships associated with the potential for depleting reserves.

4.5 Potential Implications of Further Price Increases

If, as I have suggested throughout this chapter, the price of oil does increase, there are likely to be ramifications for the global political economy. The impacts of the 1970s price spikes could provide an indication of what the implications may be. This section explores the primary impacts of deficit and recession which resulted from the 1970s oil price spikes and argues that these can provide insight into potential outcomes of further increased oil prices. As Hirsch, Bezdek, and Wendling (2005, 27) emphasise, the implications of peak oil are likely to be more severe because the price spikes from the 1970s and 2000s were temporary, whereas increased oil prices stemming from declining reserves are likely to be ongoing.

Between 1970 and 1980, the price of oil increased by approximately 865 percent; from $11.99 to $115.68 (in fixed 2021 USD). Despite these price increases, international dependence on oil compelled countries to maintain high import rates. This resulted in the transfer of greater quantities of petrodollars which were then centralised within a small number of countries. The immediate effect of this wealth transfer was the appearance of negative balance of payments in virtually all oil-importing countries (Levy 1974, 696; Hirsch, Bezdek, and Wendling 2005, 28–30).

Within industrialised countries, governments responded with policy restraint (Cleveland and Bhagavatula 1980, 599). Spending was slashed for social services such as hospitals, schools and roads as governments sought to reduce oil consumption and thus retain money in the domestic economies (Engdahl 2004, 139). Reduced spending led to decreased business activity and contributed to recession (Cleveland and Bhagavatula 1980, 599).

On the level of individual consumers, economic hardships were experienced in three main ways.

First, the price of fuel increased, and its availability decreased. Within the US, a gasoline allocation system was introduced in an attempt to ensure that existing oil supplies were equally distributed across the country. The resulting gas lines stretched for blocks and it was not uncommon for people to wait in line for an hour or two before purchasing fuel (Rutledge 2005, 151; Stobaugh and Yergin 1979, 570; Yergin 1991, 617). Second, unemployment rose. Within Germany it is estimated that 500,000 people lost their jobs as a direct result of the dual oil shocks. Third, inflation increased dramatically thereby reducing the disposable income of workers. Within Germany, inflation reached as high as eight percent (Engdahl 2004, 139–40). This combination of unemployment and inflation meant that not only did goods and services cost more, but consumers had less money with which to purchase them.

Developing countries also experienced deficit and recession partially resulting from increased oil trade bills. However, while many industrialised states were able to reduce their deficits, developing states were not as successful in this endeavour. Industrialised states were in a more favourable position to attract foreign investment from oil-exporting countries. In addition, industrialised states had greater capacity to increase their production and export of goods to oil-exporting countries (Bronson 2006, 129; Campbell 1977, 98–104; Chenery 1981, 1112; Committee on Finance United States Senate 1975, 18; Levy 1974, 697; Spiro 1999, 128).[78] With less ability to reduce their deficits, non-oil-producing developing states collectively experienced the greatest hardships from the 1973/4 and 1979/80 price spikes.

With limited ability to reduce their trade deficits, the balance of payments deficits for low and lower-middle income states increased from $44.11 billion to $52.46 billion between 1973 and 1974 (World Bank n.d.).[79] In order to finance their deficits, many developing states received loans from banks within industrialised states. These loans were initially beneficial in that they facilitated the continued functioning of the states' economies. However, in 1979 interest rates increased with the so-called 'Volker Shock', and the price of oil spiked once again (Di Muzio 2015, 127). These two factors culminated in a further increase of debt to $161.86 billion by 1980 (in 2021 USD) (Cleveland and Bhagavatula 1980, 602; World Bank n.d.). In order to make inflated repayments, many states required new loans to service their existing loans (Clark 2005a, 22; Cleveland and

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[78] See Chapters 3 and 6 for an exploration of the methods used by the US to mitigate some of the impacts of balance of trade deficits resulting from oil imports. See Chapter 6 for an examination of how industrialised states increased investments and exports to reduce their trade deficits in the 1970s and 1980s.

[79] These data are in fixed 2021 USD and includes oil-exporting low and lower-middle income states.

Bhagavatula 1980, 602; Di Muzio and Robbins 2016, 82–83; El-Gamal and Jaffe 2009, 3; Healey 1979, 220). By 1982, Mexico, Argentina, and Brazil entered rescheduling agreements with international bankers and the IMF to avoid default (Brittan 1982, 548; Clark 2005a, 22; George 1994).[80] Ultimately the deficits incurred from increased oil prices exacerbated existing economic conditions and contributed to the developing world's debt crisis.

A more recent example of the economic and social disruption brought on by oil shocks is the crisis which followed the 2000 price spike in Europe. As illustrated in Figure 4.4, the price of oil increased from $27.92 in 1999, to $42.83 in 2000. This occurred at a period when the exchange rate of the euro was low against the USD. Although the crisis only spanned a few days, the effects were severe. Supermarkets began rationing food, schools were shut down, transportation decreased dramatically across Western Europe, and protests were wide spread (Clark 2005a, 34–35). This indicates that even brief episodes of rapidly increased oil prices can induce severe hardships.

If oil prices do indeed escalate once more moving into the future, the economic hardships resulting from the 1970s price spikes may be replicated and intensified. Deficit resulting from an increased transfer of funds in exchange for oil could lead to structural debt as it did in the developing world during the 1970s and 1980s. Decreased funds within state economies could lead to recession as economies contract. Inflation may rise as businesses raise prices in an attempt to reduce their own hardships. If this is to occur, these impacts are likely to be experienced by individuals, communities, countries, and the international community. However, unlike in the 1970s, increased prices following peak oil have the potential to be long-lasting rather than temporary.

4.6 Conclusion

In this chapter, I argued that the price of oil is likely to rise moving into the future. The finite nature of oil, coupled with high consumption rates, suggest that at a certain point global demand will bypass accessible supply. The result will likely be increased prices over time. Our existing economic system is heavily invested in the consumption of oil. While it is used in the production and manufacturing of many products, three sectors represent our civilisational dependence: petrochemicals, agriculture, and transportation. Petrochemicals are used as an ingredient in many of our manufactured goods, including plastics and medicines. While our current system may be able to function with reduced access to petrochemicals, it would not be without a harsh adjustment process. Our agricultural system is largely based upon a large-scale, oil-intensive model. This

[80] Debt within the developing world and the loans extended during this period will be explored in more depth in Chapter 6.

form of agriculture has facilitated the sustenance of a growing global population, and (coupled with the market system) has resulted in large portions of the population lacking the means or knowledge to produce food for themselves. Finally, transportation is crucial to the functioning economic system, and the transportation sector is heavily dependent on oil. In a transnational market-economy where specialisation and division of labour rule supreme, transportation is a necessity. Without access to affordable transportation, our diffused but interconnected economic market system would face severe disruption. At present, no viable alternatives exist to replace oil to a sufficient degree to prevent the hardships resulting from peak oil. While unconventional oil has prolonged the oil-age by increasing supply, at best it is a short-term solution. Advances have been made in alternative energies for transportation, and alternative sources for the petrochemicals sector. However, oil consumption is expected to increase in these sectors over the next few decades. As peak is reached and oil production goes into decline, the results are likely to be detrimental to the global political economy. Previous oil crises do not present a perfect example of the likely impacts of peak oil, as peak has the potential to be a prolonged crisis, while previous oil-price increases have been temporary. However, previous crises do provide insights into the probable outcomes: recession, inflation, greater deficits, greater unemployment, and more debt.

Chapter 5. The Rising Wealth of Oil-Exporters

5.1 Introduction

As oil is only produced and exported in large quantities by a small group of countries (see Chapter 2), the global consumption of oil results in a transfer of wealth from oil-importing states to oil-exporting states. This income stream is referred to as petrodollars as the majority of oil is traded in USDs. In this chapter, I generate datasets to determine the extent of this transfer, and the countries which are the prime beneficiaries of the transfer (largely OPEC), as well as comparing this transfer to global GDP to signify its contribution to the global economy. These datasets represent gross turnover in exchange for oil-exports. I also generate data for the ten largest exporters of 2015 taking into consideration the extraction costs and therefore deriving a closer approximation of the annual profits that major exporters are earning in exchange for their oil.[81] These datasets represent one of the key innovations of this thesis since, to the best of my knowledge, the current literature has so far neglected such data and calculations. Going forward, I argue that this represents a massive gap in our knowledge given the oil dependence (albeit unequal) of the global political economy. While petrodollars were prevalent in the academic literature during the mid-1970s to early-1980s, with a few notable exceptions, they have been largely absent since this time (see El-Gamal and Jaffe 2009; Higgins, Klitgaard, and Lerman 2006; IMF 2006; Nitzan and Bichler 2002, 198–273; 1995; Spiro 1999). By generating these unique datasets, my thesis can provide insight into the financial role that oil imports and exports have played in the global economy since 1980 and thus contribute to answering my research question '*What is the current role of petrodollars in the global political economy given historically high oil prices?*' The implications of this wealth transfer and potentially destabilising future ramifications will be explored in Chapter 6.

5.2 Methodology

In order to estimate the quantity of petrodollars being transferred as a result of oil exports, I collect published data on oil exports, oil prices, global GDP, and oil production costs. I then use these

[81] An unfortunate reality of addressing a lacuna in the literature is that the desired data are not always readily available. The difficulties in obtaining recent and accurate production cost data, as well as a justification for why slightly dated 2015 data have been deemed the most appropriate, are outlined in Section 5.2.

existing datasets to generate unique datasets on the value of gross petrodollars earned globally, and within OPEC, as well as their contribution to global GDP. I also generate data on the net petrodollars earned by ten key exporters in 2015. The petrodollar datasets generated in this manner are not definitive, they are educated approximations based on available data within an industry which is notoriously opaque (Clark 2005a, 80–81; Pfeiffer 2006, 32; Tsoskounoglou, Ayerides, and Tritopoulou 2008, 3081). In this section, I outline the origin of the source data used in the generation of my petrodollar datasets and justify their use. I then list and explain the equations used to collate these existing datasets and generate my petrodollar datasets. The results of this analysis and a brief overview of my findings are presented in Section 5.3. Methodological limitations are examined in Section 5.4.

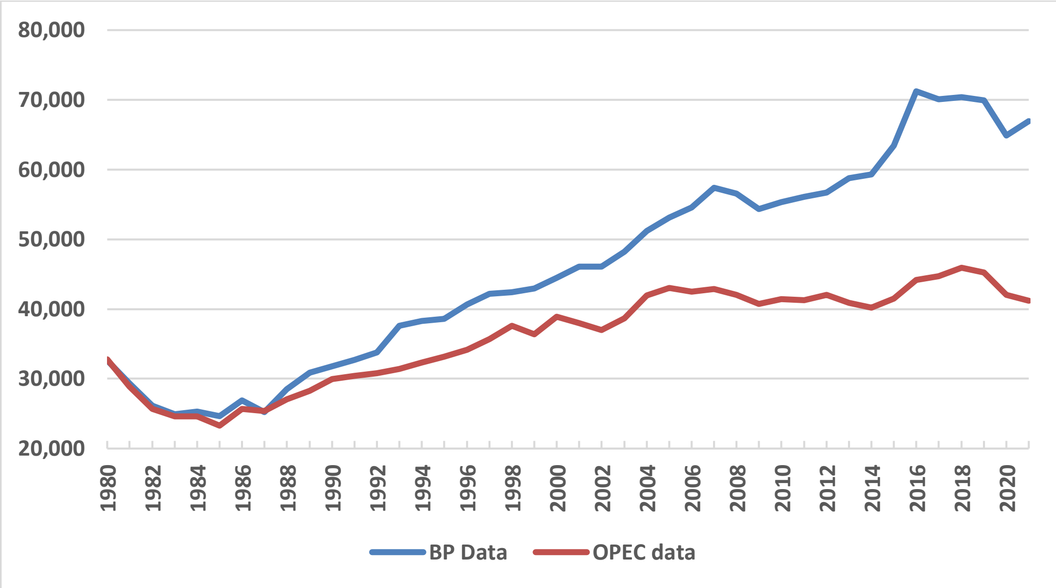
5.2a Data Collection

Exports

Global oil export data for 1980-2021 are gathered from the 2022 OPEC *Statistical Bulletin*. This source document has been used for three reasons. First, it provides export data for individual countries, regions, and economic blocs over this period. In contrast, the BP *Statistical Review* only contains inter-regional trade figures for six individual states, seven selected regions, and total global figures. As the OPEC *Statistical Bulletin* includes export figures for all oil-exporting states, these data facilitate the generation of more specific figures regarding key exporters, and therefore more rigorous analysis. In addition, as the OPEC *Statistical Bulletin* includes export data for all oil-exporting states, their global data is traceable and reproducible.

The second key justification for utilising the oil export data in the OPEC *Statistical Bulletin* over that contained within the BP *Statistical Review,* is that there is significant discrepancy between the two datasets, and OPEC provides more explicit information regarding the materials their data are based upon. As is illustrated in Figure 5.1, until 1988 the data on oil exports from both sources remain relatively similar and varies by a maximum of 1.4 million barrels per day. However, by 2021 the discrepancy reaches 25.7 million barrels per day (BP 2022b; OPEC 2022). This variation could be accounted for by the products included in the organisations' calculations. While the OPEC *Statistical Bulletin* data focus on crude oil exports alone, BP does not clearly state which materials are included in their data, and petroleum products may be included as well as crude oil. When OPEC's data are expanded to also include exports of petroleum products, the trendlines still vary substantially in value, but are more similar in trajectory (see Figure 5.2), indicating that BP's data likely do include petroleum products.[82] Crude oil exports are the focus of this study, and so OPEC's data on crude oil exports are used, and data pertaining to refined petroleum products are excluded.

Figure 5.1: BP and OPEC Global Oil Export Data 1980-2021 (thousand barrels per day)

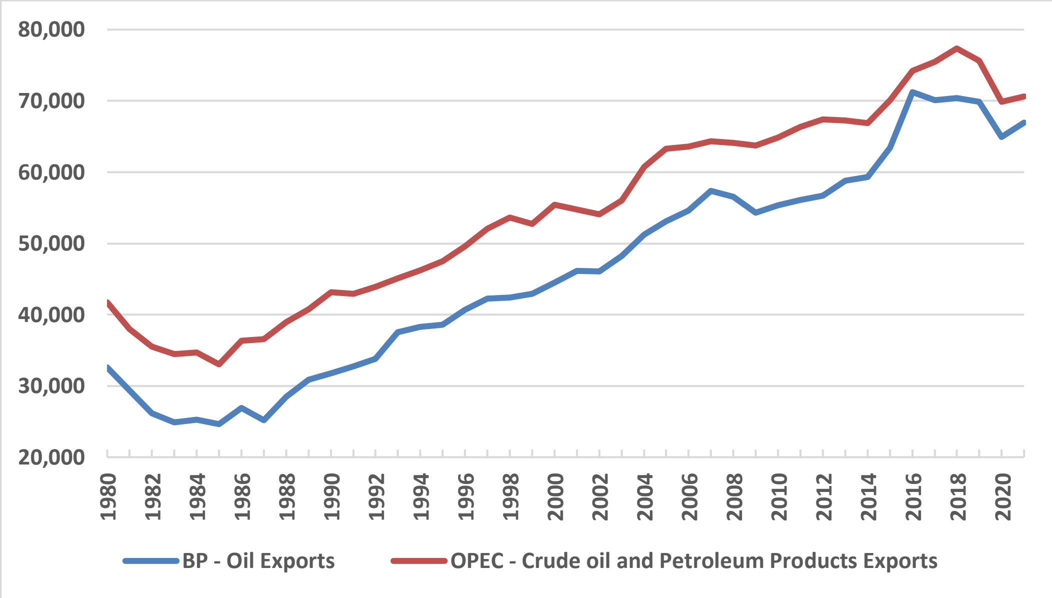


Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2.

The third justification for using the oil export data published in the OPEC *Statistical Bulletin*, is that when comparing both sources' data on 'oil exports' OPEC's figures are lower than those in the BP *Statistical Review* (see Figure 5.1). As such, petrodollar estimations based on these data will be more conservative and less likely to be inflated than if based on the figures published by BP.

[82] It is not possible to definitively identify why there is still a discrepancy in the quantities reported and illustrated in Figure 5.2. However, it is likely a result of either variations of which petroleum products are included, or incomplete country data in the BP *Statistical Review*.

Figure 5.2: BP and OPEC Global Oil Export Data (including petroleum products) 1980-2021 (thousand barrels per day)



Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbls. 5.2 and 5.3.

Prices

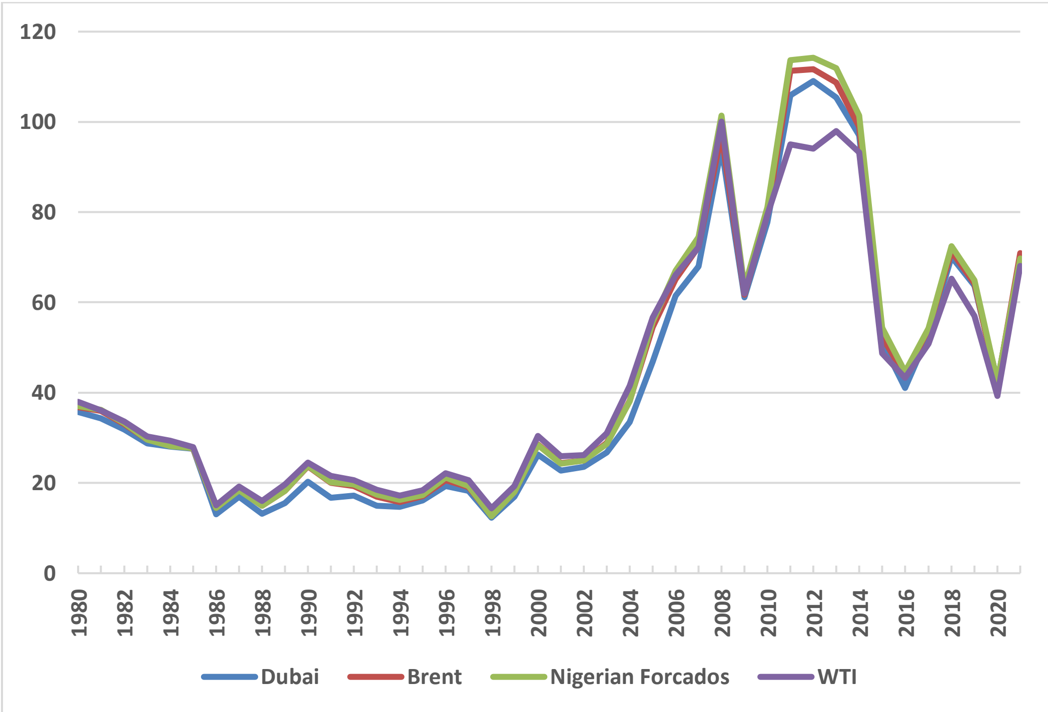
Global oil prices are collected from the 2022 BP *Statistical Review*. Oil is traded against several benchmarks; the four primary ones being Brent Crude, Dubai Fateh, Nigerian Forcados, and West Texas Intermediate (WTI). Each benchmark represents a different grade of oil with different levels of acidity. The benchmark selected as an input for this study is primarily Brent.[83] It has been selected as the most useful in generating my datasets for three reasons. First, Brent represents approximately two thirds of all globally traded oil (GlobalPetrolPrices.com 2019; Intercontinental Exchange 2019; Petroleum.co.uk 2015). As this study is primarily devoted to determining the global petrodollar transfer resulting from oil exports, using the benchmark which is used most widely provides for more accurate figures.

The second justification for using Brent prices is that, in addition to representing two thirds of all globally traded oil, the primary oil benchmarks have historically traded closely with each other. This indicates that the one third of global oil which trades against the other benchmarks would still be trading closely with Brent. As is illustrated in Figure 5.3, there was a four-year period from

[83] The years 1980-1983 in my gross petrodollar accumulations datasets are based off the Arabian Light benchmark. The deviation on benchmark used in these years is explained below.

2011 to 2014 when WTI traded significantly lower than Brent and Dubai Fateh. This price disparity was largely due to US discounts which were designed to make domestic purchase of US shale oil more financially desirable than purchasing international oil (Cunningham 2019; Rapier 2019). As WTI is mostly used for oil produced within the southwest of the US (although oil from other locations is priced against it) (Petroleum.co.uk 2015), and the US only accounts for approximately 7.6 percent of total global oil exports (OPEC 2022), the implications of this four-year decreased WTI price on the figures produced in my petrodollar dataset should be minimal.

Figure 5.3: Spot Oil Prices 1980-2021 in nominal USD (per barrel)



Source: BP, Statistical Review of World Energy 2022.

The third justification for using the Brent benchmark for these calculations is that Brent prices are available in both nominal and fixed figures within the chosen source material (BP 2022b). The equations used to generate my datasets require the use of both fixed and nominal prices. Nominal oil prices are used in my calculations of petrodollar accumulation as a percentage of global GDP, as will be discussed below. However, the prices used in my gross petrodollar accumulation datasets are in fixed 2021 USD. Fixed prices are the most beneficial for these datasets as they span the period 1980-2021, and fixed figures provide a more accurate illustration of how the figures have fluctuated over time. The selected dataset uses Brent dated figures from 1984-2021, however, BP (2022b) has used Arabian Light as the benchmark for the years 1945-1983. Therefore, in using this dataset, the first four years (1980-1983) of my petrodollar accumulation datasets are based on the Arabian Light benchmark. While it would be preferable to maintain consistency with the selected price benchmark, my dataset commences in 1980 in order to extend back to the period when petrodollars largely disappeared from the academic literature,[84] and using fixed prices is of high priority for analysis. It is for this reason that this dataset on fixed oil prices from the BP *Statistical Review* has been selected despite the discrepancy in benchmark for the first four years.

GDP

Global GDP are is sourced from the World Bank (2022). Published data on global GDP were only available in nominal figures or in fixed 2015 USD. In order to generate accurate percentages, both GDP and petrodollar accumulation must be based on the same price markers. Therefore, when calculating petrodollar accumulation as a percentage of global GDP, nominal figures have been used for both the GDP and petrodollar accumulation inputs to ensure mathematical accuracy.

Production costs

Usable production cost data are difficult to source. Datasets are either dated, do not include several key exporters, or do not specify whether their figures are based on nominal USD or fixed USD. The IMF has collated data on oil production costs for certain producers (Middle East, North Africa, Afghanistan, and Pakistan) over the period 2017-2019, with projections for 2020 and 2021. However, this dataset presents two main challenges. First, while it includes most of the large oil-exporting OPEC states, it does not include several key current exporters such as Russia, Canada, the US, and Mexico.[85] Second, the IMF has not caveated/signposted this dataset by specifying whether the values are fixed or nominal (IMF cited in Knoema 2021). As such, they cannot be subtracted from global oil prices to determine profit margins with any degree of accuracy.

CNN Business have collated information sourced from Rystad Energy on the production costs of oil across all ten major oil-exporting states in 2015 and the data are presented in fixed 2015 USD (Petroff and Yellin 2015). While these figures are dated, the information that can be extrapolated regarding profit margins will be much more accurate than using the data collated by the IMF, and

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[84] Hughes and Lipscy (2013) posit that a key reason the politics of energy received less academic attention during the 1980s and 1990s was that oil prices decreased compared to the spikes of the 1970s.

[85] The Rystad Energy dataset that is used also does not include information on the US, however this was less of a concern as the US was not a key oil-exporter in 2015 (OPEC 2022; Petroff and Yellin 2015).

it will include non-OPEC oil-exporting states. The data sourced from CNN Business and Rystad Energy consider production costs including building new infrastructure, extracting oil, salaries, and general administration.

By outlining a snapshot of the ten largest oil-exporters for one year, we gain insight into the net profits earned in exchange for oil-exports.

5.2b Data Collation

Global Petrodollar Accumulation

In order to generate approximations of the petrodollars which have been transferred from oil-importing states to oil-exporting states over the period 1980-2021, oil export data and oil prices are multiplied together. The number of barrels exported globally per day during each year is multiplied by the number of days per year (to allow for variance in year length, standard years are multiplied by 365 and leap years by 366). The figures generated with this equation represent the total amount of oil exported globally each year. These data are then multiplied by the annual Brent price of oil.

Global annual petrodollar transfer = (global barrels exported per day) * (days per year) * (annual price)

This equation is performed in two different tables. First it is calculated using fixed 2021 USDs. This is used for my gross global petrodollar accumulation dataset (see Figure 5.4, Table 5.1, and complete data in Appendix 1). Second, it is calculated using nominal USDs. These figures are used as an input for the petrodollar accumulation as a percentage of global GDP dataset (see Appendix 2).

Global Petrodollar Accumulation as Percentage of Global GDP

In order to ascertain the degree to which petrodollar transfers contribute to the global economy, the annual petrodollar transfer using nominal USD is calculated as a percentage of global GDP. The annual petrodollars transferred globally is divided by annual global GDP figures and then multiplied by one hundred (see Figure 5.5 and Appendix 3).

Petrodollar transfer as a % of global GDP = ((global annual petrodollar transfer) / (annual global GDP)) * 100

OPEC Petrodollar Accumulation

To determine the petrodollars accumulated by OPEC member states annually, the number of barrels exported by OPEC per day during each year is multiplied by the number of days per year (again, adjusting for leap years). These data are then multiplied by the annual Brent price of oil.

Annual petrodollar transfer to OPEC = (barrels exported per day from OPEC) * (days per year) * (annual price)

As with the global dataset, this calculation is performed twice in two tables. First, fixed 2021 USDs are used as an input to generate gross petrodollar accumulation figures for OPEC (see Figure 5.6, Table 5.2, and complete data in Appendix 4). Second, nominal USDs are used to generate the data for the OPEC petrodollar accumulation as a percentage of global GDP dataset (see Appendix 5).

OPEC Petrodollar Accumulation as Percentage of Global GDP

To determine the percentage of global GDP which is accumulated by OPEC in exchange for their oil exports, the annual petrodollars transferred to OPEC (calculated using nominal USDs) is divided by annual global GDP figures then multiplied by one hundred (see Figure 5.7 and Appendix 6).

OPEC petrodollar transfer as a % of global GDP = ((annual OPEC petrodollar transfer) / (annual global GDP)) * 100

Net Petrodollar Accumulation by Key Exporting States

The petrodollar data calculated using the above equations represent total annual gross turnover in exchange for oil exports both globally and within OPEC. To provide approximations of the annual net profits of ten major exporters in exchange for their oil exports, extraction costs are applied to the petrodollar accumulation equation. By subtracting the extraction cost per barrel from the annual price per barrel (in fixed 2015 USD)[86] then multiplying this figure by the number of barrels exported per day and the number of days per year, the net income earned in exchange for oil exports is observable (see Table 5.3 and Appendix 7 for complete data). Generating these data provides us with a greater understanding of the petrodollars earned by major oil exporters which must then be recycled through the global economy (which will be discussed in Chapter 6).

Annual petrodollar profit of major exporter = (barrels exported per day) * (days per year) * (annual price – extraction costs)

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[86] Prices in fixed 2015 USD must be used for this dataset as the available production costs are also in fixed 2015 USD.

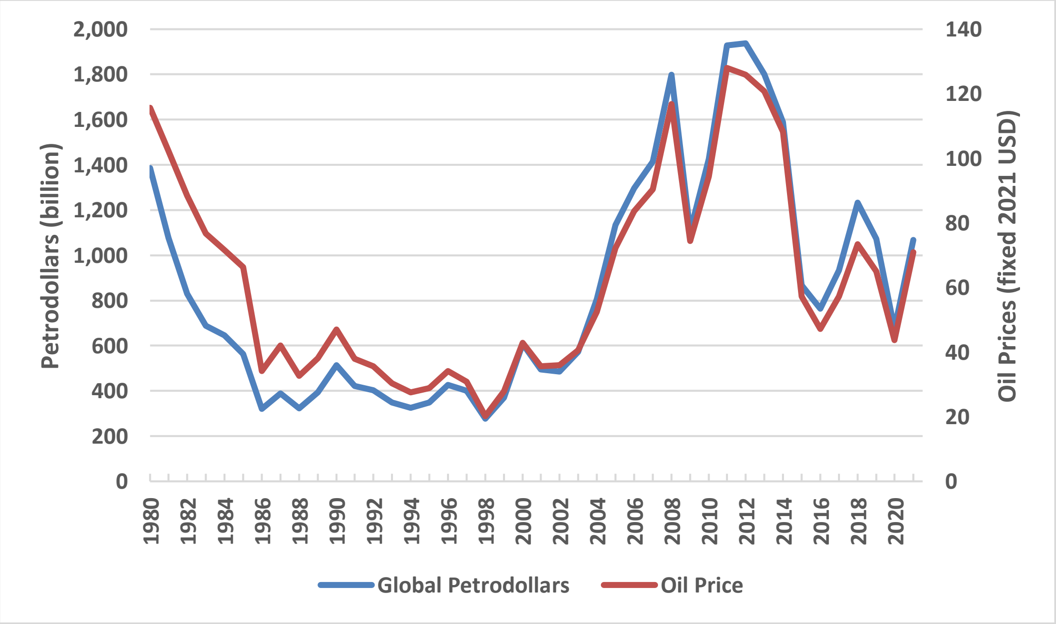
5.3 Results

Within this section, I include the datasets generated using the methodology outlined in Section 5.2 along with brief overviews of my findings. First, global petrodollar figures are illustrated, including the contribution of these figures to global GDP. Second, OPEC figures are explored, again including their contribution to global GDP. Third, the net petrodollar accumulation of ten major global exporters is outlined.

5.3a Global Petrodollar Accumulation

As is illustrated in Figure 5.4 and Table 5.1, in 1980 and 1981, between $1.4 trillion and $1 trillion was transferred annually in exchange for global oil exports. This coincided with the high price of oil during this period. However, following the decreased oil prices during the remainder of the 1980s and most of the 1990s, the transfer of petrodollars also decreased, averaging $444 billion annually from 1982 to 1999. This figure began to increase from 2000, peaking at $1.9 trillion in 2012. Between 2005 and 2014, the transfer was consistently over $1 trillion, ranging between $1.1 trillion in 2009 and as high as $1.9 trillion in 2011 and 2012. Between 2015 and 2017, the petrodollar transfer decreased (in line with falling oil prices), however it still averaged $855 billion each year. From 2018, annual petrodollars have increased to over $1 trillion again; with the notable exception of 2020 when oil prices and consumption plummeted in line with the COVID-19 pandemic.

Figure 5.4: Global Petrodollars and Oil Prices 1980-2021 in fixed 2021 USD (billion)



Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

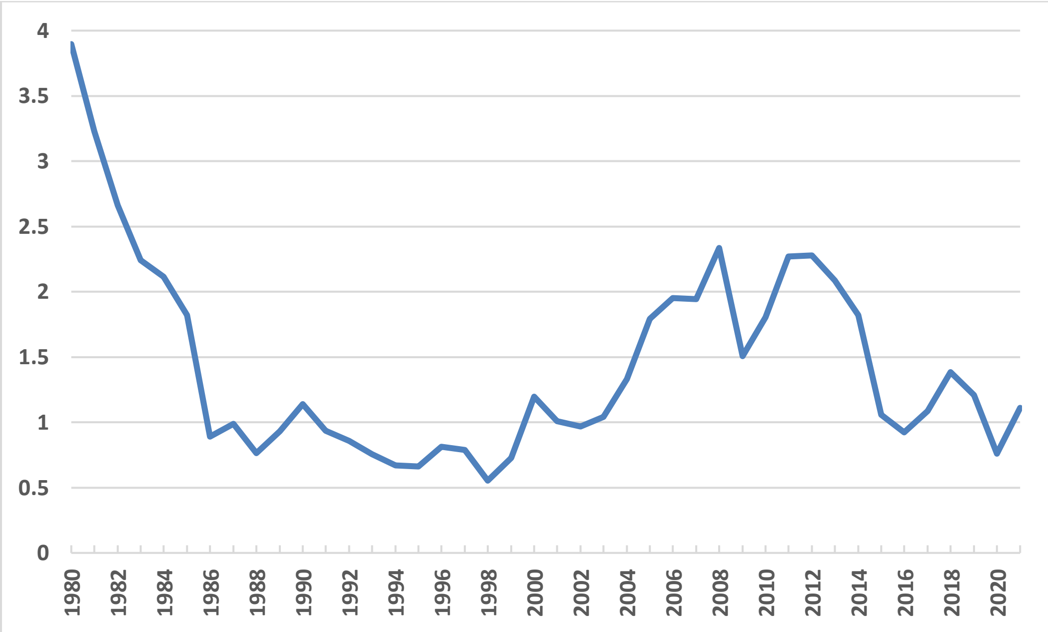
Table 5.1: Global Petrodollars 1980-2021 in fixed 2021 USD (billion)

Year Ending		0	1	2	3	4	5	6	7	8	9
Decade	1980s	1,387.27	1,077.67	829.25	689.00	646.55	563.30	319.63	389.08	323.53	392.73
	1990s	513.91	421.55	402.09	348.81	326.25	349.50	426.07	401.42	277.17	370.90
	2000s	609.25	495.70	486.49	572.52	805.40	1,134.17	1,296.90	1,415.31	1,799.65	1,105.98
	2010s	1,425.89	1,929.49	1,937.67	1,799.97	1,588.12	867.17	762.83	933.55	1,232.02	1,073.60
	2020s	673.79	1,067.09								

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

In 1980, the global petrodollar transfer represented 3.9 percent of total global GDP (see Figure 5.5). Over the following six years, this percentage decreased, reaching 0.9 percent in 1986. While it did experience fluctuations between 1987 and 2003, the contribution of petrodollars to GDP ranged between 0.55 percent and 1.2 percent; with an average of 0.87 percent. Its contribution began to increase from 2004, before reaching 1.9 percent in 2006 and 2.3 percent in 2008, 2011 and 2012. It did not drop back to one percent until 2015, since which time it has averaged 1.1 percent.

Figure 5.5: Global Petrodollars 1980-2021 as a percentage of Global GDP

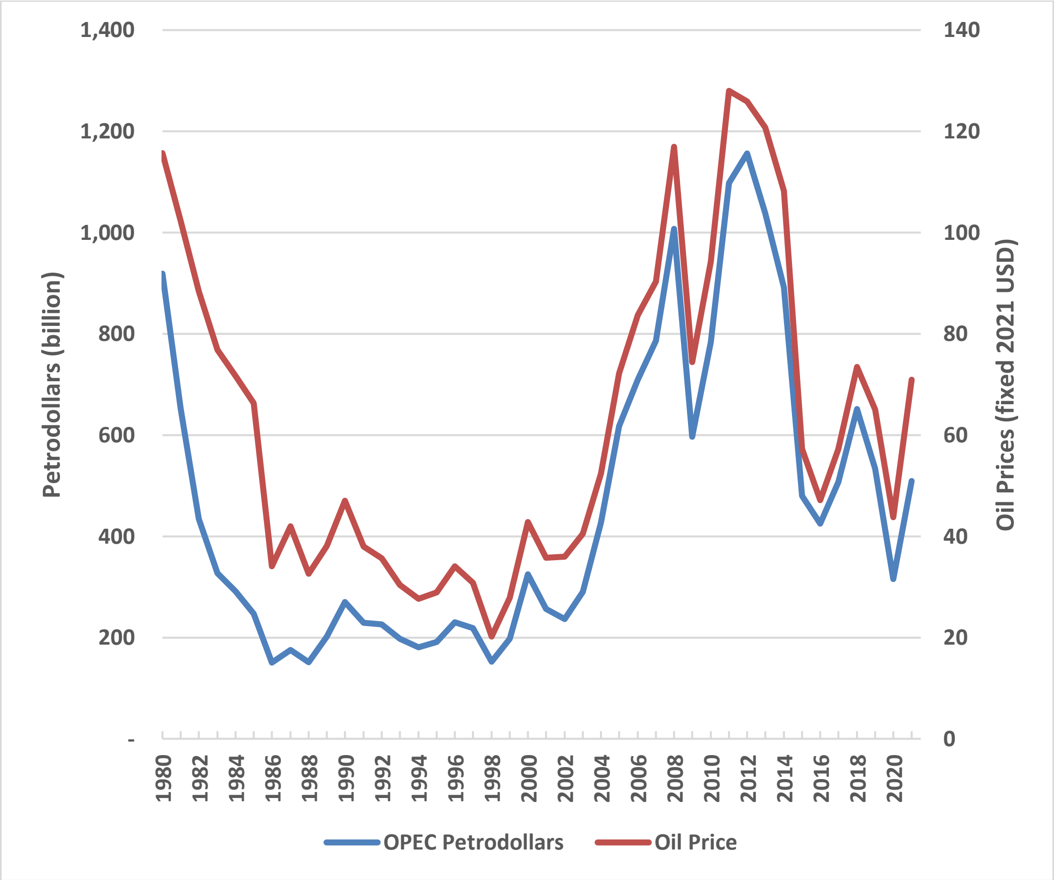


Source: BP, Statistical Review of World Energy 2022; OPEC, 'Oil Trade', Annual Statistical Bulletin, 2019, tbl. 5.2; The World Bank, 'GDP (current USD)', Indicator: NY.GDP.MKTP.CD, World Bank Group, [accessed 30/09/2022], https://data.worldbank.org/indicator/NY.GDP.MKTP.CD; calculations are author's own.

5.3b OPEC Petrodollar Accumulation

Between 1980 and 2021, OPEC has been responsible for between 43.9 percent and 66.2 percent of global oil exports (OPEC 2022, tbl. 5.2). As a result, between 43.9 percent and 66.2 percent of the annual total global petrodollar transfer has been concentrated within OPEC. OPEC's petrodollar accumulation largely followed the same trendline as that of the global petrodollar transfer (see Figure 5.4). As is illustrated in Figure 5.6 and Table 5.2, after a high of $919 billion in 1980, the amount decreased until 1986 when it reached a low of $151 billion. It then fluctuated between $325 billion and $152 billion for the next 17 years; averaging $219 billion annually between 1987 and 2003. Following this, oil prices increased and resulted in a dramatically increased petrodollar transfer, peaking at $1,007 billion in 2008. There was a drop in 2009 to $597 billion but, by 2011, the transfer had reached over $1 trillion. In 2012, it was $1.16 trillion, and in 2013, $1.04 trillion. Between 2015 and 2021, the petrodollar transfer to OPEC decreased, averaging $489 billion annually.

Figure 5.6: OPEC Petrodollars and Oil Prices 1980-2021 in fixed 2021 USD (billion)



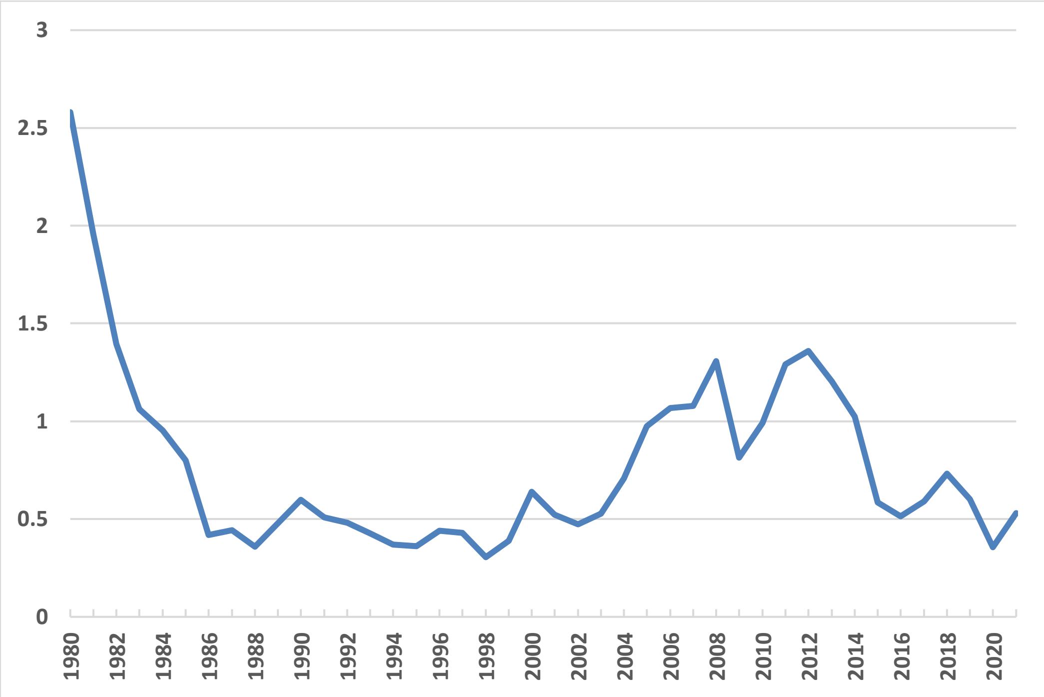
Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

Table 5.2: OPEC Petrodollars 1980-2021 in fixed 2021 USD (billion)

Year Ending		0	1	2	3	4	5	6	7	8	9
Decade	1980s	918.74	652.25	434.67	326.84	290.98	247.32	150.50	175.14	151.70	201.77
	1990s	269.77	229.36	226.17	197.52	180.29	191.11	230.50	218.58	152.73	198.07
	2000s	324.47	256.21	236.96	290.47	427.02	617.75	709.00	786.01	1,007.43	596.79
	2010s	784.52	1,098.15	1,156.36	1,038.18	891.52	480.23	424.68	506.82	651.20	533.31
	2020s	315.84	508.76								

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

Figure 5.7: OPEC Petrodollars 1980-2021 as a percentage of Global GDP



Source: BP, Statistical Review of World Energy 2022; OPEC, 'Oil Trade', Annual Statistical Bulletin, 2019, tbl. 5.2; The World Bank, 'GDP (current USD)', Indicator: NY.GDP.MKTP.CD, World Bank Group, [accessed 30/09/2022], https://data.worldbank.org/indicator/NY.GDP.MKTP.CD; calculations are author's own.

Following the second price spike of the 1970s, the percentage of global GDP which was transferred to OPEC in exchange for oil exports was 2.6 in 1980 (see Figure 5.7). In line with declining prices, this decreased to 0.42 percent in 1986. It then averaged 0.47 percent for the 17 years from 1987 to 2003. As the price of oil increased in the 2000s and early 2010s, so did the transfer of petrodollars to OPEC and the percentage of global GDP accumulated by OPEC. In 2008, 2011, and 2012 it peaked at 1.3 percent. Following the oil price decline in the second half of the 2010s, OPEC's accumulation of petrodollars as a percentage of global GDP fell back to 0.5 percent in 2016, since which time it has averaged at 0.55 percent.

5.3c Net Petrodollar Accumulation by the Ten Largest Oil-Exporters in 2015

When production costs are applied to petrodollar accumulation, we can calculate an approximation of *surplus* petrodollars; that is to say, petrodollars which do not need to be expended in extracting more oil (in other words, profit). As is illustrated in Table 5.3, OPEC members make up seven of the ten largest oil-exporting states. Several of the OPEC states also have particularly low production costs, especially Kuwait, Saudi Arabia, Iraq, and the UAE; all of which could produce a barrel of oil for $12.30, or less, in 2015. Within the ten largest exporters, Kuwait had the lowest production costs at $8.50 per barrel, and Canada had the highest at $41 per barrel.[87] With such a degree of differentiation, the fluctuating price of oil impacts upon exporters differently. As shown in Appendix 7, in 2015, the price of oil was $52.39, thus while Kuwait made an approximate profit of $43.89 per barrel, Canada's profit was a more modest $11.39 per barrel.

Table 5.3: Net Petrodollars Accumulated by the Ten Largest Oil-Exporters in 2015 in fixed 2015 USD (billion) (OPEC members marked with *)

Exporter by Rank	Country	Production cost per barrel	Surplus Petrodollars (billion)
1	Saudi Arabia*	9.90	111.09
2	Russia	17.20	62.92
3	Iraq*	10.70	45.72
4	UAE*	12.30	35.72
5	Canada	41.00	9.56
6	Nigeria*	31.60	16.04
7	Venezuela*	23.50	20.82
8	Kuwait*	8.50	31.46
9	Angola*	35.40	10.61
10	Mexico	29.10	10.60

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; Petroff, A., Yellin, T., 'What it costs to produce oil', CNN Business, 2015, [accessed 13/9/2019], https://money.cnn.com/interactive/economy/the-cost-to-produce-a-barrel-of-oil/index.html?iid=EL; calculations are author's own.

Saudi Arabia was the largest exporter in 2015, and due to low production costs ($9.90 per barrel), it accumulated the greatest quantity of surplus petrodollars by a significant margin at $111 billion.

[87] As outlined in Section 5.2a, production costs include building new infrastructure, extracting oil, salaries, and general administration (Petroff and Yellin 2015). A portion of the significant discrepancy in production costs is likely due to the geography and geology of the oil in each country. For example, Canadian production costs reflect that their oil is unconventional and predominantly found in tar sands; it is therefore more financially intensive to extract. However, oil in conventional reserves in easily accessible location (as it is in many OPEC states) is less financially intensive to extract. Another key determining factor in production costs is the percentage of oil already extracted from a reserve; as per Hubbert's bell-shaped curve, oil will become increasingly costly to extract once half of a reserve has been removed (Bardi 2009, 323; Deffeyes 2001; Hubbert 1956; Pfeiffer 2006, 30)."

Russia was the second largest exporter, and also accumulated the second largest quantity of surplus petrodollars; $63 billion. Iraq and the UAE accumulated the third and fourth largest respectively ($46 billion and $36 billion). While Kuwait was the eighth largest exporter, due to its low production costs it accumulated the fifth largest quantity of surplus petrodollars ($31 billion). Conversely, while Canada was the fifth largest exporter, its comparatively high production costs resulted in the accumulation of the smallest quantity of surplus petrodollars ($9.6 billion).

5.4 Discussion

From 2005 to 2014, between $1.11 trillion and $1.94 trillion was transferred annually from oil-importing states to oil-exporting states. This is reminiscent of the amount which was transferred in both 1980 and 1981 after the second oil price spike of the 1970s (in fact, at its highest, it is a significant increase on the petrodollar transfer of 1980 and 1981). The implications of the 1970s and early 1980s petrodollar transfer have been heavily examined in the literature; they included fiscal deficits, recession, unemployment, and long-term debt (see Chapter 4). However, the more recent transfer, which began dramatically escalating in 2000, has largely been neglected. The datasets generated in this chapter contribute to filling the lacuna in the existing literature by presenting the contemporary petrodollar transfer from the period when they largely disappeared from the lexicon. In addition, they contribute to answering my first research question which is '*What is the current role of petrodollars in the global political economy given historically high oil prices?*' Figures 5.5 and 5.7 illustrate the contribution that petrodollar accumulation makes to global GDP. Figures 5.4 and 5.6 also illustrate how this transfer fluctuates closely in line with oil price fluctuations. In this section, I highlight the significance and key implications of my results. Then, I outline the limitations of my methodology and propose methodological modifications for future research.

5.4a Significance and Implications

The petrodollar transfer is significant for four key reasons. First, it represents money which oil-importing states cannot use for other purposes. Second, accumulated petrodollars must necessarily flow back into the global economy, and the means by which this occurs have implications for the development of the global political economy and financial system (petrodollar recycling and its implications are explored in Chapter 6). Third, if oil prices continue to rise, as I argued they are likely to in Chapter 4, this transfer is likely to continue to increase thereby further exacerbating the first two factors. Fourth, the variance in production costs between oil-exporting states mean that fluctuating prices will affect oil-exporting countries vastly differently.

The gross petrodollar transfer illustrated in Figures 5.4 and 5.6 and Tables 5.1 and 5.2 represent income which oil-importing states have spent purchasing oil and thus cannot use for other purposes. This is not a unique or inherently bad phenomenon. When trading, any income spent on imports naturally cannot be spent elsewhere in the economy. However, it is the quantity and the concentration of destination which is significant. As is illustrated in Figure 5.5, between 0.8 and 2.3 percent of global GDP has been directed towards the purchasing of oil within global markets since 2000. This represents 0.8 to 2.3 percent of total global GDP which cannot be used for other purposes. While it is still much less than the percentage of GDP directed to oil purchases during 1980 (3.9 percent), the significance of its contribution to total GDP should not be discounted, particularly because, without oil, global GDP itself would be jeopardised. In addition, an average of 54.5 percent of global petrodollars has been transferred to OPEC since 2000. In other words, between 2000 and 2021, 0.36-1.36 percent of total global GDP has been accumulated by OPEC – a collection of 13 states – in exchange for oil-exports.

While some of the petrodollar transfer must be expended in extracting more oil, as is illustrated in Table 5.3, a portion remains as surplus petrodollars. In order to reduce disruptions to the economy, these petrodollars must flow back through the economy. The expenditure of surplus petrodollars can have severe ramifications for the development of the global political economy. For example, if they are used to purchase large quantities of weapons they can contribute to violence (as was discussed in Chapter 3). If they are invested, they will impact upon certain sectors of the economy by shaping the way industries develop. If they are deposited in banks, they can impact on the lending practices of banks. The implications of how these surplus petrodollars have historically been recycled, and the likely uses and implications of contemporary petrodollars, will be examined in Chapter 6.

Importantly, the annual accumulation of gross petrodollars trendlines closely follow the fluctuations of oil prices. This is to be expected as the two variables in petrodollar accumulation are oil prices and oil export rates. While export rates do experience some fluctuations, they remain largely steady and on an upwards trajectory – although becoming flatter in recent years (see Figures 5.1 and 5.2). As such, prices are the main variable impacting on fluctuations. As argued in Chapter 4, it seems likely that moving into the future, the price of oil is likely to continue to rise. Oil is a non-renewable resource which is currently responsible for meeting 31 percent of global energy needs and, without a current feasible long-term alternative (see Chapter 4), oil consumption rates are projected to remain high over at least the next two decades (BP 2022b; 2019; IEA 2018, 79; OPEC 2021). Unless there is an unexpected decrease in consumption needs, this transfer is likely to increase along a similar trendline to prices – upwards with possible destabilising implications for the global economy.

As was illustrated in Table 5.3, production costs between oil-exporters show significant variation. Within the ten largest oil-exporting states, 2015 production costs ranged between Kuwait's $8.50 per barrel and Canada's $41 per barrel. When the price of oil is as low as it was in 2015 ($52.39 per barrel), the disparity in profit margin is highly apparent. Even though Canada exported greater quantities of oil than Kuwait, Kuwait's profit was triple that of Canada's ($31 billion as opposed to $10 billion). This demonstrates the importance of recognising production costs when examining petrodollars. In addition, it provides insight into the unsustainability of some states' oil export industries at contemporary low prices. If the price of oil were to suddenly decrease and reach lower than $41 per barrel, Canadian oil, which was responsible for 5.5 percent of global exports in 2015, would no longer be viable. Conversely, if oil prices rise into the future, some states are likely to benefit much more significantly than others due to their low production costs; most notably (based off the figures in Table 5.3) Kuwait, Saudi Arabia, Iraq, and the UAE will benefit.

5.4b Methodological Limitations and Future Research Opportunities

The datasets generated in this study provide informed approximations of the petrodollars earned annually in exchange for oil exports. From these datasets, an understanding of the trajectory of this petrodollar transfer can be gained as well as insight into the scale of wealth under discussion. However, there are limitations to the methodology, including: using annual averages for input data, using one price benchmark, producing net figures for only ten exporters, and relying on datasets from BP and OPEC which purportedly report the same historical data, but which have internal unexplained inconsistencies.

My calculations are based on annual average oil prices and annual export figures. This allows for the generation of datasets illustrating annual approximations of petrodollar accumulation. However, there is substantial daily volatility in oil prices, and this volatility would be mirrored in the actual flow of petrodollars. In addition, daily export figures also fluctuate. This, coupled with fluctuating prices, would impact on daily petrodollar accumulation. Due to information access limitations, and the expansive time period covered (1980-2021), annual averages were the most practical available option to generate these petrodollar datasets for this thesis. However, the use of averages means that the datasets represent approximations, rather than definitive figures.

Annual averages of both price and export rates also limit the generation of precise figures as they do not account for speculation. Oil can currently be purchased through speculation which means that when prices appear favourable to importers, they can contractually agree to buy an amount of oil over time at that price. This means that they may import a quantity of oil over the following months which would be pegged to a particular price even as the market continues to fluctuate. If the price were low when importers bought on speculation then rose over the next few days, weeks or months, the figures generated in the above datasets would represent inflated figures. Conversely, if importers bought on speculation and then the price decreased, the figures generated above would represent deflated estimates. While the dataset is limited by its inability to account for speculation, the annual averages generated through the existing calculations are based upon the availability of information within the public domain and thus were the most practical option for this study.

This method has also used one primary benchmark to determine annual prices. The justification for this was provided in Section 5.2a: Brent accounts for approximately two thirds of global oil exports; the primary benchmarks have historically traded closely with each other; and Brent is the only dataset within the preferred primary source for which prices are published in both fixed and nominal figures. Due to these three reasons, Brent is the most useful benchmark for my datasets. However, for future research where the petrodollar accumulation of individual countries is used, more specific data could be gleaned by using the benchmark that the country tends to trade against. Utilising different, state-specific benchmarks, would also be effective if either the required data were solely for one year; did not prompt comparison with data from previous or ensuing years; or if fixed figures could be obtained for other benchmarks.

For further research, the extraction costs for all exporting states could be applied to the equation to calculate net petrodollar accumulation. While this study has applied extraction costs for ten of the prime global exporters for one year (2015) to determine their net profits, future research may be able to apply this practice more widely to generate datasets on global net profits, as well as for regions, and economic trading blocs. However, unless a researcher chose to examine only one year, *annual* production costs would need to be located and applied to the dataset equation to account for fluctuations relating to oil field development. In addition, production costs would need to be found in the same price marker as oil prices in order to produce accurate figures.

5.5 Conclusion

In this chapter, I generated unique datasets on petrodollar accumulation. Petrodollars were widely discussed in the academic literature during the mid-1970s and early-1980s (see Chapters 4 and 6), however, since this time they have remained largely absent. By generating datasets on global gross petrodollar accumulation from 1980-2021, OPEC’s gross petrodollar accumulation from 1980-2021, as well as datasets examining the contribution of petrodollar accumulation to global GDP, my research begins to fill this lacuna in the literature. These datasets show that increasing quantities of petrodollars were transferred annually from oil-importing states to oil-exporting states from 2000, peaking at $1.94 trillion in 2012. In 2012, just under 60 percent of these petrodollars were accumulated by OPEC ($1.16 trillion). This transfer of petrodollars has slowed considerably over the last few years (2015-2021) with the decrease in oil prices. However, if oil prices rise moving into the future, as I argued they are likely to in Chapter 4, this transfer is likely to also escalate once more. In this chapter, I also generated a dataset to illustrate the net surplus petrodollars accumulated by the ten largest oil-exporting states of 2015. This dataset provides insight into the surplus income generated through oil exports which must be recycled back through the economy in order to prevent economic retraction. The means by which surplus petrodollars have been recycled historically, as well as the likely methods of current recycling and their implications will be explored in Chapter 6.

Chapter 6. Petrodollar Recycling

6.1 Introduction

Historically, increased oil prices have led to a transfer of wealth from oil-importing states to oil-exporting states. Increased expenditure on oil imports can have detrimental effects on individual state economies including: reduced funds to spend elsewhere in the economy, deficits, inflation, and recession (Chenery 1975; Cleveland and Bhagavatula 1980; Engdahl 2004; Hall and Klitgaard 2012, 328, 334; Levy 1974, 699). In addition, once these funds have been accumulated, they must be recycled back into the global economy to facilitate the continued functioning of the global economic system (Committee on Finance United States Senate 1975; Spiro 1999). Importantly, these recycling methods themselves have flow-on effects for the global economy. The accumulation and recycling of petrodollars (and the impact thereof) throughout the 1970s and 1980s has been well-documented within the literature (Balaam 2014; Brittan 1982; Bronson 2006; Calleo 1981; Campbell 1977; Chenery 1981; 1975; Clark 2005a; Cleveland and Bhagavatula 1980; Di Muzio 2015; El-Gamal and Jaffe 2009; George 1994; Gilpin 2001; Healey 1979; Levy 1974; Nitzan and Bichler 2002; Pollack 1974; Shipley 2007; Spiro 1999; Thomas and Evans 2011). However, petrodollars have been neglected over the last 40 years despite a continued global transfer of wealth as identified in Chapter 5. This prompts the question: how are petrodollars recycled in the contemporary global economy?

In order to explore this question, this chapter is divided into two main sections. The first, Section 6.2, summarises the existing literature on historical petrodollar recycling. It outlines the three main recycling mechanisms used throughout the 1970s and 1980s: domestic expenditure and imports, investments, and bank deposits. When looking at the third mechanism – bank deposits – this chapter differentiates itself from the existing literature on petrodollar recycling. Most scholars examine petrodollar deposits using a fractional reserve theory of banking whereby banks acted as financial intermediaries and used deposits to make loans to countries experiencing trade deficits (Balaam 2014, 189; Brittan 1982; Clark 2005a; Cleveland and Bhagavatula 1980; Healey 1979; Pollack 1974; Spiro 1999). In contrast, I use the credit creation theory of banking which posits that banks do not need to use deposits to make loans, rather they simply extend credit (Di Muzio and Noble 2017; Hockett and Omarova 2017; McLeay, Radia, and Thomas 2014; Werner 2014a; 2014b).[88] In this way, the petrodollar bank deposits were not simply transferred to other states as

[88] See Section 1.2d for an exploration of fractional reserve theory and credit creation theory.

loans. Rather, the petrodollar bank deposits were a liability to the banks as they required the payment of interest. In order to pay this interest, the banks required new income streams. The extension of credit to countries in deficit generated income through interest payments.

The second part of this chapter, Section 6.3, updates the literature by exploring the primary methods used to recycle contemporary petrodollars. The most recent literature on petrodollars was published in 2006 and 2008, and it speculates that over the period 1999 to 2006, approximately half of accumulated petrodollars were expended on increased imports, and half were recycled through reserve accumulation and investments (Higgins, Klitgaard, and Lerman 2006; IMF 2006; McCown, Plantier, and Weeks 2006; Ruiz and Vilarrubia 2006). I identify key areas where oil-exporting states (specifically OPEC) increase domestic spending and imports. I then outline why savings deposits are unlikely to play as significant a role as they did in the 1970s and 1980s. However, petrodollars may still be deposited in foreign banks as a result of foreign exchange reserves acquisition. Finally, I explore some of the sectors which are likely to attract petrodollar investments and the implications thereof.

6.2 Historical Petrodollar Recycling

Between 1972 and 1980 the price of oil increased by 654 percent; from $15.35 in 1972 to $115.68 in 1980 (BP 2022b).[89] As consumption rates remained largely consistent over this period, this increase in price resulted in an extensive transfer of petrodollars from oil-importers to oil-exporters (see Chapter 5). This transfer led to balance of trade surpluses for large oil-exporting states, and corresponding deficits for oil-importing states (El-Gamal and Jaffe 2009, 9). In order to finance these deficits and facilitate the continued functioning of the economic system, the petrodollars needed to flow back through the economy in a process known as recycling (Committee on Finance United States Senate 1975; Spiro 1999).

In the 1970s and 1980s, recycling was practiced in three main ways:

- oil-exporters increased expenditure and imports – particularly for military hardware;
- oil-exporters invested in foreign bonds and equities; and
- oil-exporters deposited surplus petrodollars in US and UK-based banks and then these

[89] While most literature on the 1970s oil price spikes uses nominal prices ($2.48 in 1972 and $36.83 in 1980 (BP 2022b)), this thesis uses oil-prices set in fixed 2021 USD. As this thesis tracks oil prices from 1861 through to 2021, using figures which are adjusted for inflation provides a more useful basis for examining trends and comparing price increases over time.

banks extended loans to developing countries experiencing deficits.

All three methods will be explored below.

6.2a Expenditure and Imports

One key method to consume petrodollars was to increase spending for economic development. Several states, including Saudi Arabia, spent a portion of their revenue investing in themselves and developing their infrastructure; building such things as hospitals, schools and transportation networks (Campbell 1977, 97–98; Committee on Finance United States Senate 1975, 32). They also began preparing for a time when the export of oil would become a less lucrative endeavour by investing in other industries to diversify their economies. Iran, in particular, began developing its steel and nuclear industries during this period (Campbell 1977, 93–94; Levy 1974, 703). Not all oil-exporting states were in an equal position to effectively use their increased revenue for development. Factors within each state such as population size, resource deposits, and level of development impacted upon the ratio of petrodollars which were expended and accumulated (Chenery 1975, 4). Over the period 1973 to 1982, 50 percent of OPEC's total surplus was accumulated by Saudi Arabia alone. A further 25 percent was captured by Kuwait and the UAE. In contrast, Ecuador, Indonesia, Nigeria, and Algeria all experienced trade deficits (Spiro 1999, 128).[90]

Most oil-exporting states were impacted to a degree by the so-called 'resource curse'; a term referring to the phenomenon of increased prevalence of – or increased stability of – autocratic regimes, corruption, and economic underperformance in resource-rich states (Elhefnawy 2008, 44, 50; Hancock and Vivoda 2014, 209; Ross 2015, 240). The causes of the 'resource curse' are contested, and the symptoms can be varied. One factor which may contribute to the perpetuation of authoritarian regimes in oil-rich states may be that a government receiving most of its revenue from oil lacks incentive to develop popular support or a strong tax base (Hammond 2011, 352; Ross 2015, 246). An autocratic regime with oil-wealth may also be well placed to invest in repression, funding their militaries, and winning foreign support (Ross 246). Two states in particular which have experienced the 'resource curse' are Nigeria and Angola (Hammond 2011; Watts 2012). In these cases, although increased oil prices generated an influx of wealth, petrodollars were centralised in the hands of the political elite and did little to contribute to domestic development (El-Gamal and Jaffe 2009, 14–15; Elhefnawy 2008, 50; Hammond 2011; Watts 2012, 437, 439).Two elements which may impact on the degree to which countries

[90] The remaining 25 percent was divided between Iran, Libya, Iraq, and Qatar. The author omitted Venezuela and Gabon from these calculations for unspecified reasons (Spiro 1999, 128).

experience the resource curse are the level of economic development and political stability already achieved by the state prior to oil discovery and extraction. Oil was discovered relatively recently in Ghana, and due to their pre-existing levels of political and economic development, they appeared to be less likely to experience the 'resource curse' (Kopinski, Polus, and Tycholiz 2013). While they remain a constitutional democracy, they experienced economic crisis which came to a head in 2022 with public debt reaching 90 percent of GDP. Ghana has entered into an IMF Extended Credit Facility Program, however poverty is expected to increase over the next few years and the World Bank predicts that nearly 34 percent of the population will be below the international poverty line by 2025 (World Bank 2023). Another state which made strides against the 'resource curse' was Venezuela. In the 1970s, oil was the driver of a social democratic project in Venezuela, however this project was relatively short lived after the price of oil fell in the 1980s. Under President Chavez, oil-funded social spending was revived as Chavez pursued his 'twenty-first century socialism' project, funding welfare programs in education and health. In more recent years, Venezuela appears to have succumbed to the 'resource curse' with hyperinflation, falling GDP, and soaring debt leading to economic collapse, as well as increase autocracy emerging once again (Cheatham, Roy and Labrador 2023).

Another method to consume petrodollars was for oil-exporters to increase their imports. During this period, oil-importing states were facing trade deficits. In order to balance their payments, they were incentivised to maximise their exports to oil-exporting states. This resulted in an anarchic environment where oil-importers attempted to improve their own situation regardless of the impact on other states or the global economy as a whole. After the first oil shock, a summit of the seven largest industrialised democracies[91] discussed their intended response to higher oil prices. It was agreed that these countries would cooperate and respond in a unified manner in an attempt to force oil-exporters to lower their prices. However, promptly after advocating for this response, each country immediately pursued a self-interested, unilateral course of action and competed with the others to bring their individual trade payments into balance (Levy 1974, 701; Spiro 1999, 132, 142–43). The US experienced significant success in reducing their deficit by increasing arms sales to several oil-exporting countries including Iran, Iraq, Oman, and Saudi Arabia (Calleo 1981, 792–93; Campbell 1977, 93–98; Di Muzio 2015, 125; Nitzan and Bichler 2002; Spiro 1999, 87–89, 147).[92] Germany and the UK were also successful in reducing their deficits, and in fact, both reached surplus with OPEC by 1977 (Spiro 1999, 146). While these competitive trade policies

[91] At the time this included Canada, France, Italy, Japan, the UK, the US, and West Germany (The Federal Government 2018).

[92] The US' tendency to increase arms sales to OPEC during periods of higher oil prices has been explored in greater depth in Chapter 3.

proved beneficial in reducing the trade imbalances of individual states, it did not assist in reducing global imbalances. The majority of increased imports were sourced from industrialised states, meaning that the developing world's deficits required alternative methods of financing (Chenery 1981, 1112).

Increased expenditure and imports accounted for only a small portion of the collective exporters' petrodollars. Oil-exporters were accumulating wealth at such a rapid rate that they were unable to spend all of their funds (Pollack 1974, 453–54; Spiro 1999, 1). For example, in 1974 it was reported that OPEC spent approximately 25 percent of its increased petrodollar income, leaving 75 percent remaining as surplus (Chenery 1975, 2).

6.2b Investments

One method of recycling surplus petrodollars was to invest in bonds and equities. These investments were largely driven by market forces, and for this reason they were mostly drawn to developed, industrialised economies (IMF 2006, 85–87; Levy 1974, 697). The US was particularly successful in attracting investments. In fact, 22 percent of all OPEC's surplus petrodollars from 1973-1982 were invested in the US (Spiro 1999, 128). This investment in US securities helped to facilitate the continued operation of the US economy despite running balance of trade deficits (Shipley 2007, 18; Spiro 1999, 132–33, 144). As a collective, other developed countries attracted 30 percent of surplus petrodollars in the form of investments. 19 percent went to developing countries, mostly in the form of loans (Bronson 2006, 129; Campbell 1977, 98–104; Committee on Finance United States Senate 1975, 18; Spiro 1999, 128). Finally, five percent of the surplus petrodollars was invested in financial institutions (Spiro 1999, 154). Between 1973 and 1982, approximately 76 percent of OPEC's surplus petrodollars were recycled through investments, leaving 24 percent for the final recycling mechanism; bank deposits.

6.2c Bank Deposits

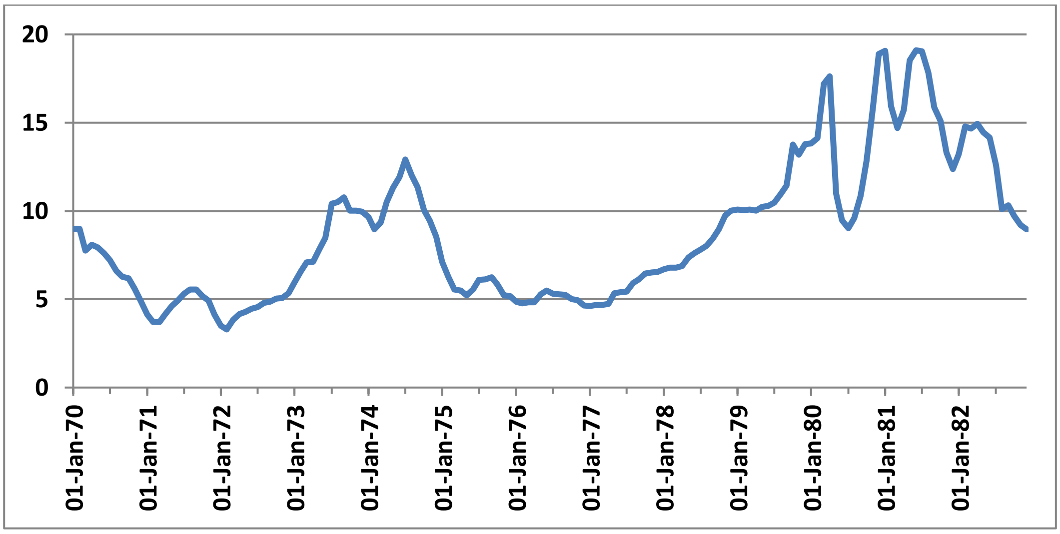
After oil-exporters had increased their spending, imports, and investments, the remaining surplus was deposited in US and UK-based banks (Clark 2005a, 21). These bank deposits then *prompted* the extension of loans to developing countries. I emphasise the word 'prompted', because the deposited petrodollars were not extended as loans in the simple manner that the majority of the literature assumes (Balaam 2014, 189; Brittan 1982; Clark 2005a; Cleveland and Bhagavatula 1980; Healey 1979; IMF 2006, 85–87; Pollack 1974; Spiro 1999). Rather, the existence of the deposits created an *incentive* for banks to extend credit as loans. This argument will be explored further below. During the period between 1973 and 1982, 24 percent of the surplus petrodollars accumulated by OPEC members were deposited in banks (Spiro 1999, 128). The subsequent extension of credit proved to be beneficial for US and UK financial interests, however it was a key factor contributing to the developing world's debt crisis, and as such was largely detrimental for developing countries (Clark 2005a, 22).

As discussed above, the first two methods of petrodollar recycling – expenditure/imports and investments – were mostly attracted by industrialised states. Developing states did not produce the industrial goods which were desired by oil-exporters, and thus they were unable to dramatically increase their exports (Chenery 1981, 1112). In addition, their underdeveloped economies made them unenticing destinations for foreign investment. While industrialised states competed with each other to reduce their own deficits as quickly as possible, developing countries were left with large, unfinanced deficits (Spiro 1999, 132). Over the period 1973 to 1974, their deficits doubled (Chenery 1975, 258). They were prime candidates for large international loans.

The loans extended as a result of petrodollar bank deposits facilitated developing states' continued economic activity in the face of large balance of payment deficits. However, they were detrimental to the developing world on two counts. First, they permitted developing countries to prolong their high consumption of oil, encouraging continued unsustainable practices and postponing an adjustment to the new prices (Calleo 1981, 790). Although it is crucial to acknowledge that if developing countries' deficits were not financed, the sudden and dramatic inaccessibility of oil would have resulted in brutal hardships, and the ramifications of such a reduction in energy access could have been as severe and prolonged as those caused by petrodollar loans and their ensuing debt. However, it remains that the loans extended during this period undermined potential shifts towards reduced energy consumption and simply delayed the impact of higher oil prices.

Second, many developing countries were unable to effectively use their loans to generate increased income which resulted in an increasing inability to service their loans. This situation worsened in 1979 when, not only did the price of oil spike again, but the loans' variable interest rates skyrocketed during the so-called 'Volcker Shock'. Upon his appointment as Chairman of the Federal Reserve, Paul Volcker dramatically increased interest rates in an attempt to reduce US inflation (Di Muzio 2015, 127). One of the outcomes of this decision was that the interest repayments for the developing world dramatically increased. Figure 6.1 depicts the effective federal funds rate from January 1970 to December 1982. It indicates an increase of approximately 314 percent over the period between January 1977 and June 1981; from 4.61 percent to 19.1 percent (FRED n.d.). It cannot be said that these figures are exactly reflective of the petrodollar loans' terms. However, banks use the federal funds rate as a guide to set their loan interest rates and, as such, the general trendline is likely to be similar; large spikes and increased volatility during the period from 1979 to 1981. By the early 1980s, many states were unable to repay the interest on their loans and were forced to borrow further in order to service their existing loans (Clark 2005a, 22; Cleveland and Bhagavatula 1980, 602; Di Muzio and Robbins 2016, 82–83; El-Gamal and Jaffe 2009, 3; Healey 1979, 220). Some were unable to remove themselves from this cycle of debt, and in 1982, Mexico, Argentina, and Brazil entered into rescheduling agreements (Brittan 1982, 548; Clark 2005a, 22; George 1994).

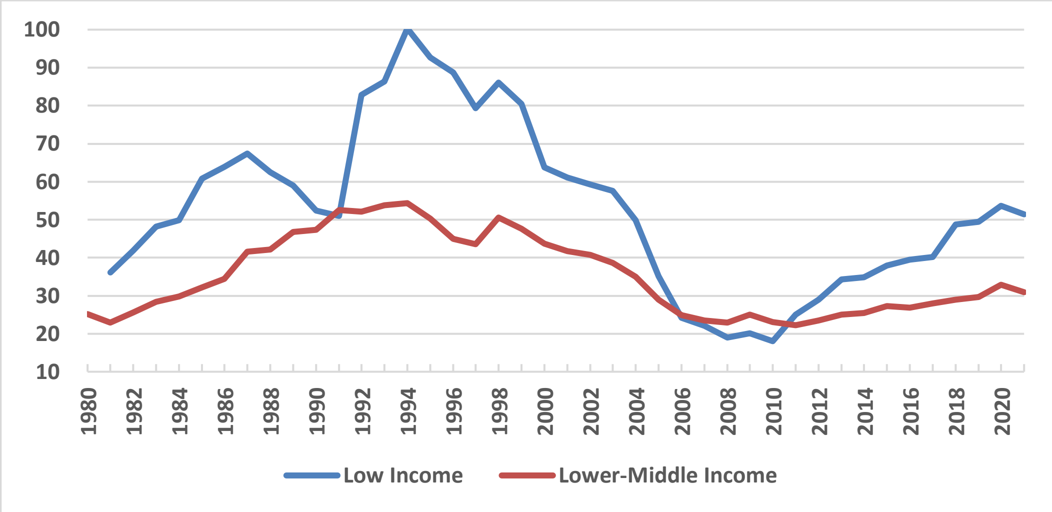
Figure 6.1: US Effective Federal Funds Rate January 1970 to December 1982 (percent)



Source: FRED, Federal Reserve Bank of St. Louis, 'Effective Federal Funds Rate (FEDFUNDS)', https://fred.stlouisfed.org/series/FEDFUNDS, 8/2/2019.

To facilitate debt repayment, the IMF implemented Structural Adjustment Programs (SAPs) in indebted countries. Neoliberal policies and austerity measures were put into effect. Market-oriented strategies were introduced as the countries' economies were opened to foreign investment and the role of governments was reduced or reorganised. In addition, government expenditure on social services such as education, health and welfare was decreased (Brittan 1982, 548; Clark 2005a, 22; Gilpin 2001, 313–14; Thomas and Evans 2011, 465). Despite the rigorous application of SAPs, in many cases decreased debt was not an outcome. Figure 6.2 outlines the debt of low and lower-middle income states from 1980 to 2021 as a percentage of gross national income (GNI). It demonstrates that their collective debt continued to escalate into the mid-1990s. In fact, in 1994, external debt was 100 percent of the GNI of low-income states. And, while it decreased between 1994 and 2010, external debt as a percentage of GNI has been higher than it was in 1981 for low and lower-middle income states from 2015 to 2021.

Figure 6.2: External Debt Stocks of Low Income and Lower-Middle Income States 1980-2021 (percent of GNI)



Note: External debt as a percentage of GNI for low-income states is not available prior to 1981.

Source: World Bank, 2022. 'External debt stocks (% of GNI) | Data' International Debt Statistics, series marker: DT.DOD.ECT.GN.ZS

It is in the analysis of these loans and their ensuing debt that the distinction between petrodollars being *extended* as loans, and as *prompting* loans becomes significant. As mentioned above, most existing literature presents the petrodollar loans as if the money was simply temporarily transferred between bank accounts. The narrative is that the money was sitting in an oil-exporter's savings account and, as it was not immediately needed, was loaned out to another party where it could be useful and stimulate economic activity. Naturally, the intention was that it be repaid before the oil-exporting state wished to access it. The act of extending petrodollar loans has for the most part been presented as the simple act of moving money from one bank account to another (Balaam 2014, 189; Brittan 1982; Clark 2005a; Cleveland and Bhagavatula 1980; Healey 1979; Pollack 1974; Spiro 1999). Using this approach to banking, the loaning of petrodollars to the developing world seems practical. If the money were sitting there, temporarily unneeded, it seems natural that it should be loaned to others, especially if those others were experiencing hardship. Using this interpretation, the bank is presented as an actor with little agency or special power. They are presented as a cog in the financial machine without an agenda or any obvious incentive to make these loans. However, this is not how banks operate. Banks are not simply financial intermediaries who organise the location of temporarily 'surplus money'. Instead, when banks make loans, they create deposits by extending credit and expanding their balance sheet. Existing savings deposits within the banks are not part of the transaction. The bank creates credit which it then provides as a loan to another party. It then expects that credit to be repaid (after which the credit ceases to exist) and, crucially, the bank expects the additional payment of interest. When we examine petrodollar loans using the credit creation theory of banking, we can ascertain the agency and financial motivation of banks to extend these loans, and their role in the developing world's debt crisis.

When surplus petrodollars were deposited in US and UK-based banks, they represented a liability for the banks. Savings deposits require the payment of interest from banks to the depositors. In this sense, they are a drain on the profit margins of banks. When oil-exporters made large deposits in US and UK banks, they created a necessity for these banks to generate additional income streams which would cover, if not exceed, current and future interest payments on the deposits. As the US and UK were both experiencing recession during the 1970s, the banks sought foreign loan opportunities (George 1994). By extending credit to developing countries experiencing trade deficits, the US and UK banks could use the interest paid on these loans as income.

Using the credit creation theory to view petrodollar loans raises two primary concerns. First, the banks extracted a profit by their unique institutional ability to create credit. They created credit, as Werner (2014b, 16) says, 'out of thin air' and then used this to generate income in the form of interests and fees. While it could be argued that the shareholders took on risk in extending these loans (a potential justification for generating profit in this manner), I argue that their risk should not be overstated. The risk to shareholders was primarily decreased profits, however the real risk associated with these loans was carried by the economic system as a whole.

In a worst-case-scenario where states default on their loans, the debt could potentially have been cancelled. In line with common practice, the extended credit was to be destroyed immediately upon repayment to the bank; the principal only exists temporarily as a means to accumulate interest payments. Cancelling the debt would have simply ended the banks' connection to the credit earlier than planned. Upon its cancellation, the shareholders of the banks would lose little more than future interest payments which could also cause their share prices to decline and thus future income streams to diminish. However, due to systemic risk, defaults would have been detrimental to the global economy as a whole. The 2008 GFC provides an example of how significant and destructive wide spread defaults can be (see George 2010; McNally 2011). In addition, in 1982, when states did threaten default, the IMF stepped in to ensure continued debt repayment by rescheduling loans and extending additional credit. These refinanced or extended loans came with legal ties that would make national governments (often undemocratic in nature) restructure their economies; turning these states into what Di Muzio and Robbins (2016, 84–85) have called 'debt repayment machines'. As such, the risk to banks was diminished while the shareholders profited from the payment of interest accrued on credit that had been pulled from 'thin air'. In other words, the true risk was taken on by the economic system as a whole, rather than those select few who profited from the practice; the risk was socialised and the profit was privatised.

Second, when loans are created as credit, while the bank creates the principal, the interest needs to be found from the existing money supply elsewhere in the economy. The issue here becomes clear if we can visualise an example. Let us imagine that a bank has extended a loan of $500,000 for a period of 30 years with an interest rate of 4.61 percent per annum (the effective federal funds rate in January 1977) and repayments to be made annually. The total amount of money owed to the bank in relation to this loan is $932,826. In other words, the bank has created a debt of $932,826, while only creating $500,000 of new money. The additional $432,826 must come from the existing money supply. This practice means that there is always more debt than the ability to repay that debt.

Interest and fees can either come from economic growth, or, when economic growth is not generated, it can be appropriated from other sectors (Trainer 2011, 77). As mentioned earlier, during the 1970s and 1980s, several developing states were unable to generate economic growth, and as a result they implemented harsh domestic policies in order to facilitate loan repayments (Cleveland and Bhagavatula 1980, 603). The result was a steady reallocation of funds from the economies of developing states to the profit margins of the banks' shareholders. Importantly, this flow of income was directly to the detriment of the developing states as needed foreign exchange drained from their economies. This transfer was intensified during the late 1970s and early 1980s when interest rates increased. Expanding on our previous example, let us now imagine that interest rates have increased to 19.1 percent (the effective federal funds rate in June 1981). The total amount of debt created for a loan of $500,000 would be $2,880,208. While the bank created the principal, the additional $2.3 million of debt must be found from the existing money supply and be redistributed to the bank.

Higher interest rates and the second oil price spike led to greater cut-backs and, in several cases, to the implementation of SAPs and increasing debt. The shareholders of the major commercial banks capitalised the ability of developing countries governments to implement austerity measures and the ability of the IMF to enforce repayment given that future credit would not be extended unless the institution gave its endorsement.

If banks did operate under fractional reserve banking, the extension of loan would not necessarily make debt systemic. If a bank were to take $100 that it had in a savings account and loan it to a borrower with the expectation that it be returned with an additional $4.16, there would always be sufficient money to repay that loan. The transactions would simply depend on a redistribution of funds. However, by creating the principal 'out of thin air' and expecting repayment with interest, there is not enough money in the total money supply to repay the debt, and this makes debt systemic. Understanding this foundational banking practice casts the practice of petrodollar recycling through loans and the developing world's debt crisis in a new light. Banks were incentivised to extend loans to developing countries experiencing hardship, they capitalised on governments' ability to implement austerity measures, took on little personal risk, and contributed to systemic debt in the developing world.

6.2d Summary

There were three mechanisms used to recycle petrodollars during the 1970s and 1980s. First, oil-exporting states could increase their expenditure and imports. Although this was not an outcome equally available to all oil-exporters, some were able to use their petrodollar income to develop and diversify their economies and improve their infrastructure. Second, oil-exporters could invest internationally. Approximately 76 percent of surplus petrodollars were recycled in this manner, with the vast majority directed to industrialised economies. The third mechanism was the deposit of remaining surplus petrodollars in US and UK-based banks. These banks proceeded to make loans to the developing world. While the loans did provide a degree of immediate economic relief, they contributed to prolonged, ongoing debt and economic hardship. Most existing literature assumes that petrodollar loans were a simple transfer of funds between bank accounts, however by using the credit creation theory of banking, an alternative picture is presented. Rather than petrodollar deposits creating loans, they created an incentive to extend loans due to the banks' demand for an increased income stream to the detriment of developing states. In other words, they created an incentive to rob Peter to pay Paul.

6.3 Contemporary Petrodollar Recycling

There is extensive information available regarding both the extent of petrodollars accumulated in the 1970s and early 1980s, and their recycling mechanisms and ensuing impacts. However, not only have there been insufficient data gathered on more recent petrodollar accumulation, but the recycling and impacts of those petrodollars has also been neglected. In 2006, four papers were published on the topic of contemporary petrodollar recycling, thereby demonstrating a brief re-interest in the topic (Higgins, Klitgaard, and Lerman 2006; IMF 2006; McCown, Plantier, and Weeks 2006; Ruiz and Vilarrubia 2006). Since this time however, the price of oil has continued to fluctuate, as has the accumulation of petrodollars, and this has been sorely overlooked by the literature.

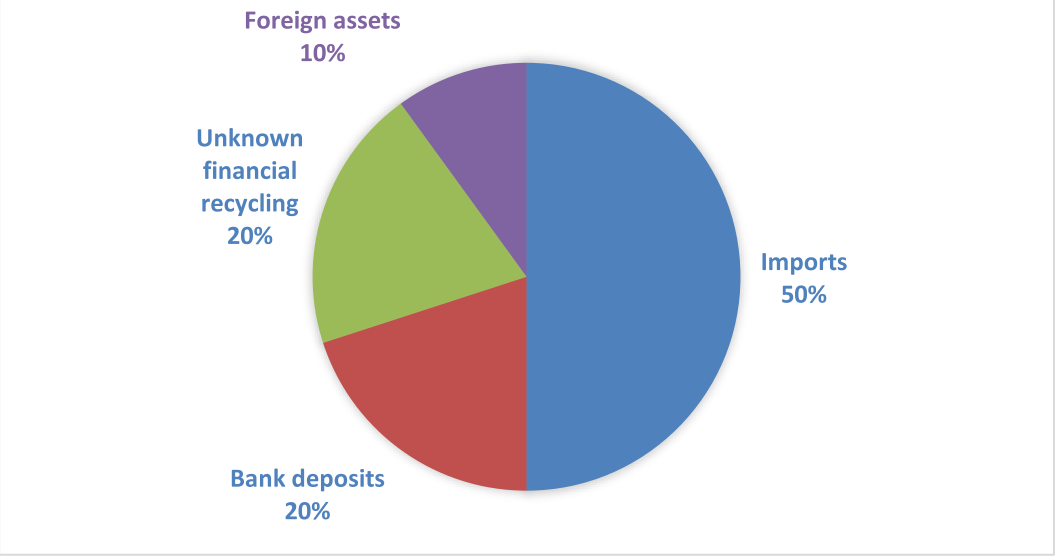
In this section, I begin with a review of the most recent literature on petrodollars. I then explore the recycling mechanisms which have been utilised. In particular, I examine the expenditure of petrodollars through increased spending and imports, with a particular focus on oil production costs, arms imports, and domestic development. Then I outline why saving deposits (which were utilised extensively in the 1970s and 1980s) are likely a less significant method of recycling, and note that petrodollars could still be deposited in foreign banks as a result of purchasing foreign reserves. Finally, I explore some likely directions of investments and argue that the majority of petrodollar investments are almost certainly directed towards developed economies.

6.3a Literature Review

2006 Reports

Interest in petrodollars received a brief resurgence in 2006, with several international and government bodies publishing papers on contemporary petrodollar accumulation and recycling practices. While the specific figures varied across the reports, it was agreed that in the first half of the 2000s, approximately 50 percent of surplus petrodollars were expended through increased imports. The remaining 50 percent were accounted for by reserve accumulation and foreign investments (Higgins, Klitgaard, and Lerman 2006, 1; IMF 2006, 73–76; McCown, Plantier, and Weeks 2006; Ruiz and Vilarrubia 2006). Within this second category, the US Department of the Treasury speculated that approximately 20 percent were deposited in banks; ten percent were used to purchase foreign assets; and 20 percent were likely recycled through the financial system although their destination could not be traced (McCown, Plantier, and Weeks 2006).

Figure 6.3: Petrodollar Recycling 1999-2006



Source: Higgins, Matthew, Thomas Klitgaard, and Robert Lerman. 2006. "Recycling Petrodollars." Current Issues in Economics and Finance 12 (9); IMF. 2006. "Oil Prices and Global Imbalances." World Economic Outlook; and McCown, T. Ashby, L. Christopher Plantier, and John Weeks. 2006. "Petrodollars and Global Imbalances." 1. Occasional Paper. Department of the Treasury, Office of International Affairs.

Each report provides limited data on petrodollar accumulation. Either the data are based on nominal prices (Higgins, Klitgaard, and Lerman 2006; IMF 2006), and/or is provided for only two separate years (Higgins, Klitgaard, and Lerman 2006; McCown, Plantier, and Weeks 2006). Neither sporadic dates nor unadjusted figures allow for analysis of trends over time, and as such these petrodollar datasets have limited utility. As an exception, Ruiz and Vilarrubia (2006), provided a dataset for OPEC petrodollars accumulated over the period 1970-2006 in fixed 2005 USD. The use of the 37-year time period provides a sound illustration of increases and fluctuations over time. My work builds upon this to include the ensuing 15 years.

All four 2006 reports note significant challenges faced in tracking petrodollar recycling. The first challenge they highlight is that expenditure of petrodollars cannot be separated from the expenditure of income generated through other means (Higgins, Klitgaard, and Lerman 2006, 2). While this is technically true, it is by no means an insurmountable limitation. BP and OPEC datasets can be used to determine petrodollars accumulated by country using the methodology outlined in Chapter 5, and GDP is readily available from numerous sources. From this information, at minimum, the percentage of expenditure which came from petrodollars could be inferred. When tracking petrodollar recycling, it is not necessary to track the movement of specific individual dollars. Indeed, attempting to do so would be a gross overcomplication. Tracking petrodollars requires that the flow of a portion of wealth be followed, and considering petrodollars as a portion of GDP would be sufficient.

The second identified challenge is more significant. When exploring petrodollar expenditure through increased imports, only the initial round of trading is tracked. Flow-on secondary and third round trading are obscured (Higgins, Klitgaard, and Lerman 2006, 4–5). For example, if a portion of petrodollars was spent purchasing luxury cars from Italy, it is likely that Italy would spend some of these petrodollars purchasing carbon fibre from the Republic of Korea. Then the Republic of Korea would likely further recycle a portion of the petrodollars by importing polyacrylonitrile from Japan. Thus, while first round imports could be tracked to Italy, a thorough picture would be much more complex and nearly impossible to trace.

The third significant identified challenge is that tracing investments is complicated when oil-exporting states utilise investment agencies to manage their petrodollars. Several countries, including the UAE, Saudi Arabia, and Russia, have been known to use investment agencies to manage their surplus petrodollars. Currently, there are no strict requirements to report transactions, and, as a result, tracking petrodollar investments made through investment agencies is challenging (Weisman 2007). This is further complicated by poor reporting on the part of countries which receive investments. For example, if Saudi Arabia uses a UK-based investment agency or bank as an intermediary to purchase US bonds and equities, this transaction will be recorded as having originated in the UK rather than in Saudi Arabia (Higgins, Klitgaard, and Lerman 2006, 5). This inadequate reporting means that, although the authors of the reports could deduce that approximately half of the petrodollars were invested, it is unclear where these petrodollars were invested, or what they were invested in.

2008 IMF Working Paper

A second IMF working paper was published in 2008 (Wiegand 2008). Its primary focus was on the role of contemporary petrodollar loans. However, the premise of this paper is fundamentally flawed as it assumes a fractional reserve theory of banking. It argues that a large portion of petrodollar bank deposits were lent to emerging economies (Wiegand 2008). However, as explored in Chapter 1 and Section 6.2, the fractional reserve theory of banking does not accurately reflect how banks make loans. While the author may be correct that there is a correlation between petrodollar bank deposits and loans to emerging economies, they are incorrect about the causation. The deposits over 2001-2006, highlighted in the working paper, likely created the *impetus* for extending loans. However, the deposits themselves were not used to create loans. Wiegand (2008) posits that if petrodollar accumulation slows and therefore petrodollar deposits decrease, there will be less funding to emerging markets and subsequent hardships for those emerging economies. While decreased petrodollar deposits could indeed result in fewer loans, this would represent reduced creation of credit rather than reduced transfers of petrodollars. While the impact would likely be the same, the cause would not.

Addressing Limitations

The data generated in this thesis works to address the limitations identified in the 2006 reports, as well as covering the ensuing 15 years. The data I provide in Chapter 5 spans the period from 1980 to 2021. It encompasses all oil-exporting states while also providing more specific figures on OPEC's petrodollars, and the individual petrodollars accumulated by ten key exporters. In addition, it uses fixed figures and is therefore more beneficial when examining changes over a period of time.

6.3b Expenditure and Imports

The 2006 reports speculate that approximately 50 percent of petrodollars were recycled through increased spending and imports (Higgins, Klitgaard, and Lerman 2006; IMF 2006; McCown, Plantier, and Weeks 2006; Ruiz and Vilarrubia 2006). That would equate to approximately $648 billion in 2006. If this trend has continued, an annual average of $653 billion petrodollars would have been consumed through expenditure and imports over the period 2006-2021.[93] While the economies of oil-exporting states are too diverse to track all imports, we can speculate on key areas of spending.

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[93] These quantities are calculated using the petrodollar dataset at Table 5.1. The values are in fixed 2021 USD.

Oil Production

A portion of money accumulated through oil exports must necessarily be expended in producing more oil. Table 6.1 illustrates the percentage of accumulated petrodollars consumed in oil production by OPEC states in 2015. There was vast disparity in the percentages used in this manner by individual countries; ranging from Angola expending approximately 67.6 percent of its petrodollars, to Kuwait expending 16.2 percent of its petrodollars on production costs. However, as a collective, approximately 30.45 percent of the petrodollars earned by OPEC states in 2015 were consumed by production costs. This means that 69.55 percent, or $297.69 billion of OPEC's 2015 petrodollars remained as profit (see Appendix 8 and Petroff and Yellin 2015).[94]

Table 6.1: Percentage of OPEC Petrodollars Expended in Oil Production in 2015

Country	Production cost as a percentage of petrodollars
Algeria	38.9
Angola	67.6
Iran	24.1
Iraq	20.4
Kuwait	16.2
Libya	45.4
Nigeria	60.3
Saudi Arabia	18.9
United Arab Emirates	23.5
Venezuela	44.9
OPEC	**30.45**

Note: This table is based on 2015 OPEC membership, Ecuador and Qatar are omitted as there are no available production costs for those two states.

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; Petroff, A., Yellin, T., 'What it costs to produce oil', CNN Business, 2015, [accessed 13/9/2019]; calculations are author's own.

Table 6.1 provides only a snapshot of oil production costs in one year; 2015. We could consider these figures indicative of preceding and subsequent years, however we cannot extrapolate with

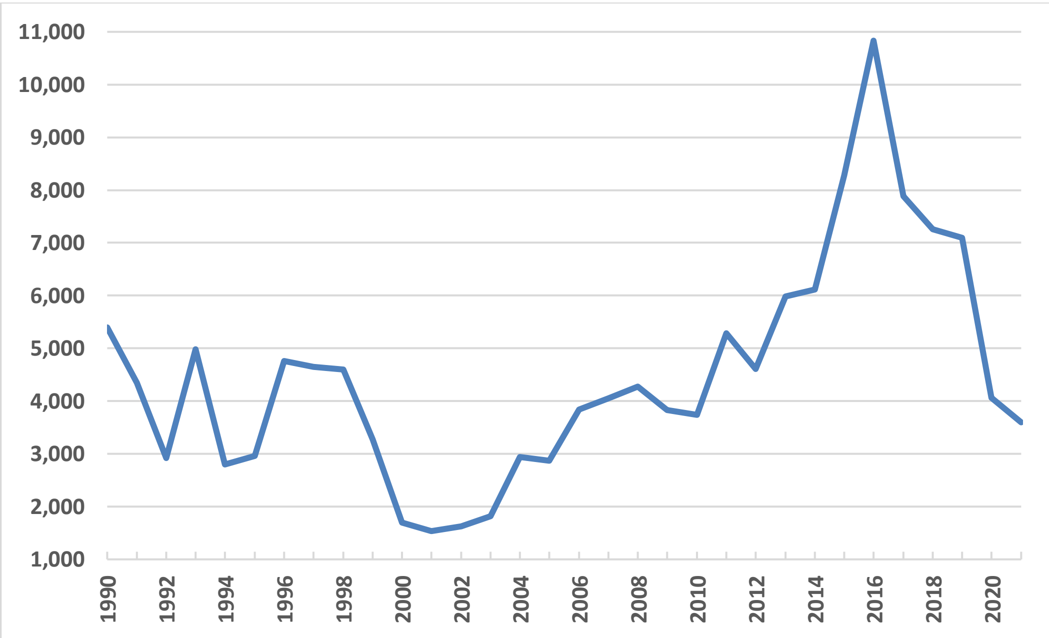
[94] These figures have been calculated using fixed 2015 prices and include data for countries that were members of OPEC in 2015, with the exception of Ecuador and Qatar as Petroff and Yellin (2015) do not include production costs for these two states (see full dataset at Appendix 8). The absence of these two states from calculations also explains discrepancies between the data in Appendix 5 and Appendix 8.

any degree of certainty due to the number of variables. When applying Hubbert's prediction that extraction of resources should become increasingly financially intensive once peak production is reached, it is likely that oil production costs have increased since 2015 (See Chapter 1 and Bardi 2009, 323; Deffeyes 2001; Hubbert 1956; Pfeiffer 2006, 30). However, production costs could have been passed on to the market as part of the oil price increases since 2015. Without updated production costs, we cannot confidently use these figures as anything other than a snapshot of how 30.45 percent of petrodollars were expended in 2015.

Arms Imports

In the 1970s and 1980s, oil-exporters used surplus petrodollars to purchase large quantities of weapons and other military equipment (Calleo 1981, 172–73; Nitzan and Bichler 1995; Spiro 1999, 87–88, 147). In recent years, oil-exporters continued to purchase large quantities of military equipment, however petrodollars have increased at a greater rate than arms imports, and as such arms imports no longer capture a significant portion of petrodollars.

Figure 6.4: TIV of Arms Imports to OPEC 1990-2021 (million)



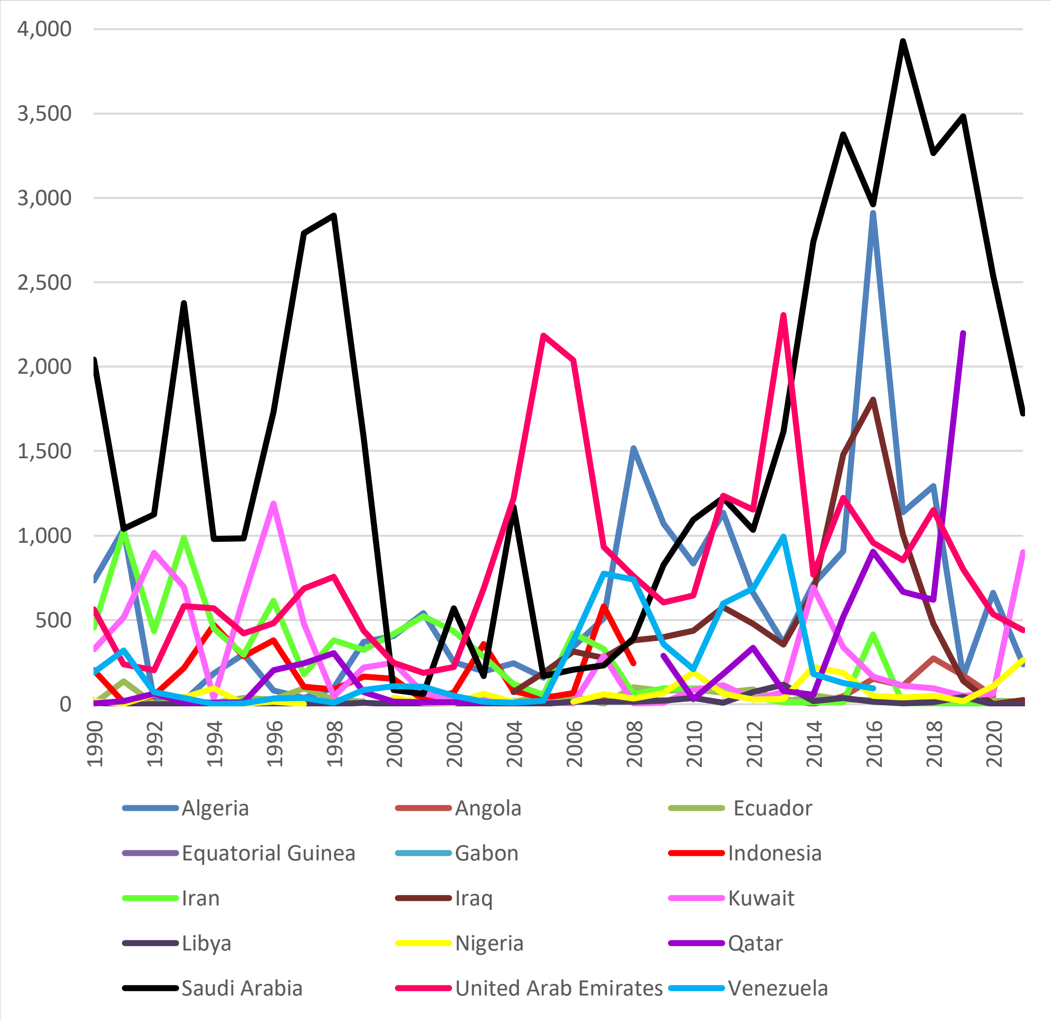
Note: This figure includes TIV data for all states that were members of OPEC for the duration that they were OPEC members.

Source: SIPRI, 'Importer/Exporter TIV Tables'.

URL https://armstrade.sipri.org/armstrade/page/values.php, (accessed 19/01/2023).

Figure 6.4 illustrates the trend-indicator value (TIV) of arms imports to OPEC over the period 1990 to 2021. Over this time, the TIV ranged from a low of $1.5 billion in 2001 to a high of $10.8 billion in 2017, with an annual average of $4.5 billion. There was significant variance between the arms imports to each OPEC state over this time (see Figure 6.5). Saudi Arabia, the UAE, and Algeria imported the greatest amount, accounting for just over 66 percent of the total arms imported by OPEC states during this 32-year period. Saudi Arabia and the UAE were also key global arms-importers over this time, being the second and eighth largest arms-importers respectively.[95]

Figure 6.5: TIV of Arms Imports to OPEC Member States 1990-2021 (million)



Note: This figure includes all states that were members of OPEC during this period. The TIV data are included only for the period that each state was an OPEC member.

Source: SIPRI, 'Importer/Exporter TIV Tables'.

URL https://armstrade.sipri.org/armstrade/page/values.php, (accessed 19/01/2023).

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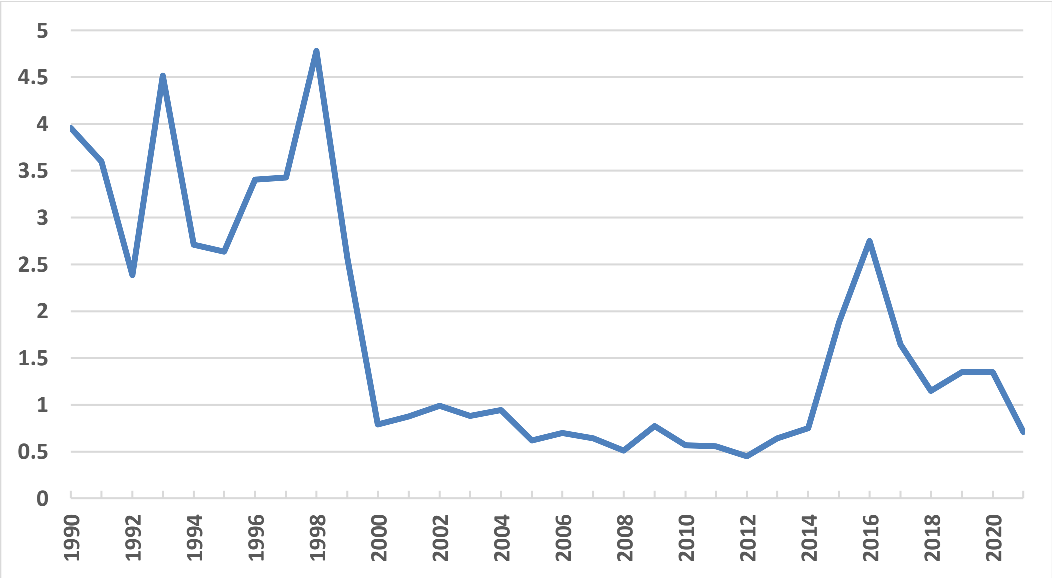
[95] The top ten arms importers over this period were (in order): India, Saudi Arabia, China, South Korea, Turkiye, Egypt, Japan, the UAE, Australia, and Pakistan (SIPRI 2022b).

Despite being the best data available, the Stockholm International Peace Research Institute's (SIPRI) TIV is limited. Rather than reflecting sale prices, TIV figures reflect production costs. Therefore, the actual amount expended on arms imports will be higher than indicated in Figures 6.4 and 6.5 as the figures do not include profit margins. SIPRI states that due to their calculation, TIV figures cannot be directly compared to data such as GDP. Nonetheless, while accepting that accuracy will be limited, we can compare TIV figures to accumulated petrodollars to present an indicative comparison.

Figure 6.6: OPEC's TIV Arms Imports as a percentage of OPEC Petrodollars 1990-2021



Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; SIPRI, 'Importer/Exporter TIV Tables'. URL https://armstrade.sipri.org/armstrade/page/values.php, (accessed 19/01/2023); calculations are author's own.

Figure 6.6 illustrates OPEC's TIV arms import figures as a percentage of accumulated OPEC petrodollars over the period 1990-2021 (with the caveat that due to TIV calculations, the figures are a low-ball approximation of what the actual values would be). Between 1990 and 1998, arms imports were used for between 2.4 and 4.8 percent of OPEC's accumulated petrodollars. From 1999, however, the portion of petrodollars spent on arms imports appears to have decreased. Over the period 2000-2021, OPEC's imports have accounted for an average of one percent of their accumulated petrodollars. This is not due to decreased imports. As illustrated in Figure 6.4, the TIV of arms imports has increased over this period. This proportional decrease is due to the dramatic rise in petrodollar accumulation since 2000. Arms imports remain significant in that petrodollar accumulation allows oil-exporting states – in this case, specifically OPEC – to import large quantities of arms, and these imports have significant implications for the political economy.

However, over the last 20 years, arms imports have become less significant in the context of petrodollar recycling; making up only one percent of OPEC's accumulated petrodollars.

Continued expenditure of petrodollars on arms exports carries a risk of perpetuating global political and economic instability. The greater militarisation of oil-exporting countries will most likely lead to increased regional conflicts, and potentially *global* conflicts. Historically, instability in oil-exporting regions has been followed by oil price increases as conflicts create fears of production shortages (Nitzan and Bichler 1995, 232). Several examples are available to demonstrate this phenomenon: the price spike following the 1979 Iranian revolution (Hall and Klitgaard 2012, 213); price increases during the Iraqi invasion of Kuwait (Noguera 2013); and increased prices in 2003 when the US and its allies invaded Iraq (see Chapter 3), to list just a few. If oil-exporting countries are purchasing large quantities of weapons, the likely result will be international instability and further increases to oil prices. This will intensify the hardships already anticipated from higher oil prices stemming from resource depletion and increased consumption needs (see Chapter 4).

Development and Diversification

Several oil-exporting countries have used surplus petrodollars to improve domestic living standards. For example, in 2005 Saudi Arabia and the UAE increased wages in the public sector by 15 and 25 percent respectively (McCown, Plantier, and Weeks 2006).[96] And Qatar's GDP increased so rapidly that it went from having the world's 27th highest GDP per capita in 1999 (when the contemporary petrodollar accumulation began) to having the sixth largest GDP per capita from 2011 until 2014 (World Bank, n.d.).[97] Some states are also pouring petrodollars into education, with Saudi Arabia opening a university in 2009 set to rival the Massachusetts Institute of Technology, Qatar building the Sidra Medical and Research Center which commenced biomedical research in 2015, and the UAE opening partner branches with several international universities (Al-Shobakky 2008; England 2009).

Some oil-exporting states have also used petrodollars in productive domestic investments to support growth and to diversify their economies. The UAE presents an example where the economy has diversified away from energy markets. In 2018, Dubai's primary income sources were wholesale and retail trade (26 percent of GDP), transport and storage (12 percent), financial and insurance activities (ten percent), and tourism (five percent) (Government of Dubai 2019, 29,

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[96] The UAE's increase of public sector wages by 25 percent in 2005 only applied to nationals (McCown, Plantier, and Weeks 2006).

[97] In 2021, Qatar had the world's 14th largest GDP per capita.

143). Another example is Saudi Arabia's National Investment Strategy. Goldman Sachs (2023) estimates that Saudi Arabia will invest approximately $1 trillion by the end of the 2030. Some of this investment is in alternative energy (as will be expanded below), others will go towards metals and mining, transportation and logistics, and a digital transformation.

Other states are diversifying within the energy sector. As an example, Saudi Arabia has been developing their renewable electricity sector. In 2012, they announced a $109 billion investment in a domestic solar farm with the intention of generating 33 percent of their electricity needs by 2032 (although this date has been extended to 2040) (Bloomberg News 2015; Mahdi and Roca 2012; Salameh 2015). Saudi Arabia also recently announced their plans for a hydrogen fuel plant and their goal of dominating the international hydrogen market and securing their role as an energy exporter into the future (Al-Atrush 2022; Nakano 2022; OPEC 2021). They are also continuing to invest in their oil capacity, and in their petrochemical products industry (Goldman Sachs 2023).

The expenditure and imports highlighted in this sub-section is not an exhaustive list. There are too many significant oil-exporting countries receiving large influxes of petrodollars with diverse economies and fiscal policies to be able to determine the extent and destination/origin of all domestic expenditure and imports. A valuable future research project would be a deep dive into case studies of a few key oil-exporters to examine GDP spending per sector compared with oil income, as well as individual imports. While a deep dive such as this is beyond the scope of this thesis, the above highlights a few key methods by which petrodollars are currently consumed.

6.3c Deposits

During the 1970s and 1980s, a prime mechanism for recycling petrodollars was through UK and US-based bank deposits. However, it is unlikely that many petrodollars are currently stored in this manner. Bank deposits (savings accounts) were previously a lucrative financial option, especially while several oil-exporting states did not have advanced financial systems. Within the current global financial system, it is much more likely that petrodollars would be invested, as investments give a much better rate of return than savings accounts.

McCown et al. (2006) speculated that a significant portion of petrodollars (20 percent) were ultimately deposited in international banks. While this may still be the case, they are likely directed to banking institutions for investment, or as a result of purchasing foreign exchange reserves. The vast majority of purchased foreign reserves likely originate in developed economies, and US assets would be particularly attractive to oil-exporters. Due to the USD remaining the primary currency of global oil trade (although there is increasing diversification as discussed in Chapter 3), oil-exporters have an interest in maintaining the strength of the USD. In addition, the US is generally seen as a safe investment with a good rate of return and deep capital markets

(Hammoudeh, Sari, and Alesia 2009).

The purchasing of reserves has political economic ramifications. On the one hand, it is a financial decision, as foreign reserves can have a good rate of return on investment. At the time of writing, in February 2023, a US Treasury Bond can be purchased for $100 with a four percent interest rate paid bi-annually for periods of 20 or 30 years (U.S. Department of the Treasury, n.d.). On the other hand, foreign assets represent an ownership of foreign debt, and with that comes a degree of economic and political leverage. In addition, when a country purchases foreign assets, that transaction becomes a liability to the foreign state. Not only does the state need to repay that money, but they must do so with the addition of regular interest payments. In 2020, The US Department of Treasury reported that Saudi Arabia held $137.6 billion of US treasury bonds (cited in Alshareef 2022). Interest rates have fluctuated dramatically over the past few years, and the Department of Treasury did not specify in what year these bonds were purchased, and we thus cannot determine the terms under which these bonds were bought. However, for the sake of illustration, we will use the current terms for US treasury bonds; four percent interest over a 20 year period (U.S. Department of the Treasury, n.d.). If Saudi Arabia purchased these $137.6 billion worth of treasury bonds today, the US would be required to pay Saudi Arabia $5.5 billion of interest every year for the next 20 years. In addition, the US would then need to repay the principal of $137.6 billion at the end of the term. The US must find this annual $5.5 billion elsewhere in the economy, either by using the principal productively to generate the interest, or by selling more reserves and increasing government debt.

The implications of purchasing foreign reserves are not limited to petrodollar recycling. Naturally, any purchase of foreign reserves carries the obligation of repayment with interest. However, as the price of oil increases, oil-importing states are likely to run balance of payment deficits. The decision of oil-exporters regarding which foreign reserves they purchase will impact on which countries' deficits are financed. The ownership of large portions of foreign debt also results in economic and political leverage which could be used for unknown purposes in the future and could result in changing power dynamics.

6.3d Investments

The 2006 reports referenced in Section 6.3a speculated that approximately 50 percent of petrodollars were invested (Higgins, Klitgaard, and Lerman 2006; IMF 2006; McCown, Plantier, and Weeks 2006; Ruiz and Vilarrubia 2006). This would have equated to approximately $648 billion (in 2015 USD), or approximately one percent of all stocks traded globally that year (World Bank n.d.). While there is little publicly available information on the investments of oil-exporting states, I will highlight below a case study of Saudi Arabia, and then consider the highest capitalised sectors to speculate on some likely directions of investments.

Saudi Arabia's Public Investment Fund (PIF) predominantly focuses on domestic investment, with four of their six investment portfolios centring on Saudi sectors and projects (for example, the development of green technologies). Of their international investment portfolios, information is vague. PIF states that their investments are diverse and encompass healthcare, consumer services, technology, real estate, transportation, and infrastructure in the Americas, Asia, Europe, and Africa. However, they caveat the above information by noting that it does not necessarily represent current investments (Public Investment Fund 2023). Table 6.2, illustrates the top ten companies within which PIF had investments as of March 2023 as reported by CNBC. Interestingly, despite highlighting that they invest in the Americas, Europe, Africa, and Asia, the top ten companies PIF currently invest in are all based in the US.

Table 6.2: Top ten PIF holdings (as of March 2023)

	Company	Industry	Country	Investment (million USD)
1	Lucid Group	Manufacturing	US	8,916
2	Activision Blizzard	Technology	US	3,245
3	Electronic Arts	Technology	US	2,988
4	Uber	Transportation	US	2,309
5	Take Two Interactive	Technology	US	1,362
6	Live Nation Entertainment	Entertainment	US	880
7	Air Products and Chemicals	Chemicals	US	776
8	Meta	Technology	US	691
9	Starbucks	Consumer Discretionaries	US	657
10	PayPal	Business Services	US	569

Source: Rohan Goswami, 'Lucid, Activison, EA, Uber: Here's where Saudi Arabia's sovereign wealth fund has invested", CNBC 2023.

While the investments of PIF provide some insights into Saudi Arabia's strategic interests, this sovereign wealth fund is open to international investors, and an unknown portion of these investments could be flowing from non-oil exporting countries. As such, we can infer the flow of Saudi Arabian petrodollars from PIF investments, however we cannot draw definitive conclusions from this dataset.

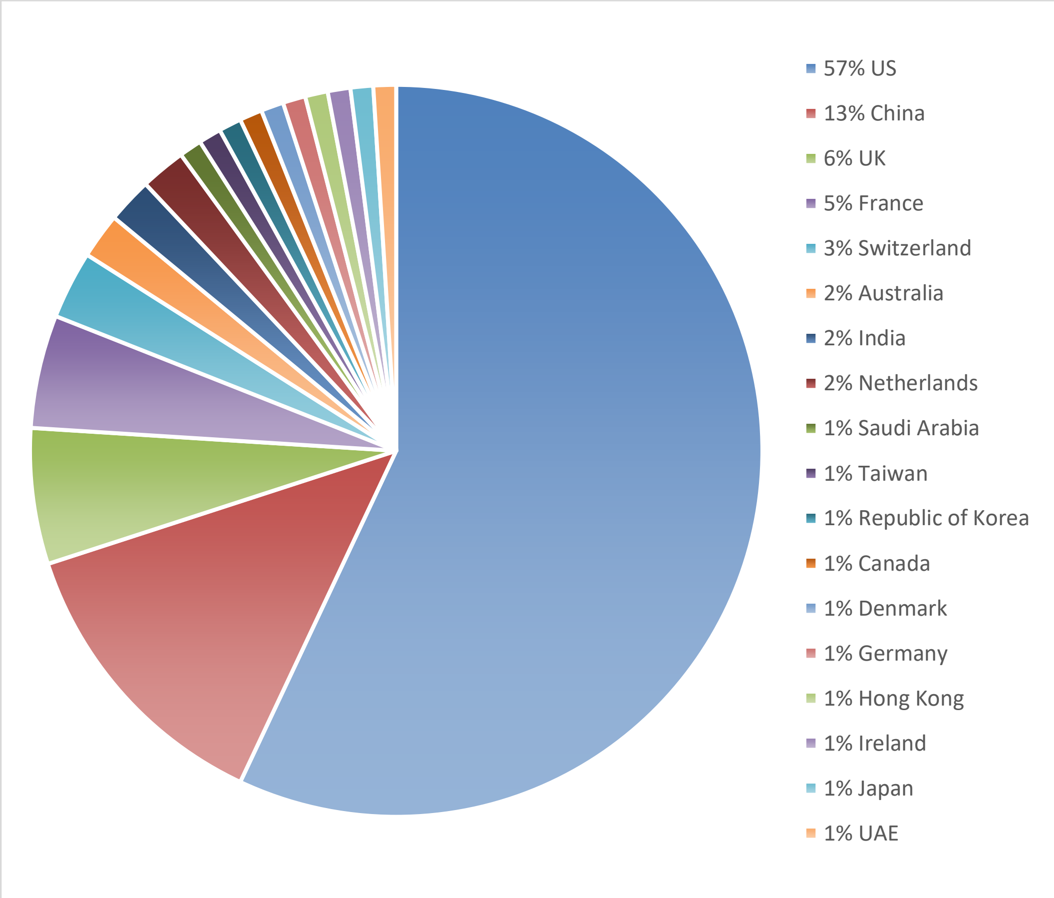
A list of the world's largest companies by market capitalisation shows that as at 26 January 2023, the largest sector by market capitalisation – and by a significant margin – is technology. In fact, of the top ten global companies, six are in the technology sector. The largest individual technology companies are Apple (1), Microsoft (3) and Google (4), all of which are valued at over $1 trillion

(Companiesmarketcap.com n.d.).[98] While we cannot know definitively which companies are receiving petrodollar investments, it is safe to assume that some are flowing to technology companies. This appears to be supported by PIF's current investment strategy.

The following three largest sectors are banks/finance, oil and gas, and pharmaceuticals (Companiesmarketcap.com n.d.). Again, while not being able to trace the investments, it is still reasonable to assume that petrodollars flow to these sectors due to their size. Within these top sectors, the most interesting in terms of petrodollars is oil and gas. Of the 288 publicly traded oil and gas companies, only six are from OPEC states (two are based in Saudi Arabia, and four are based in the UAE). Comparatively, more than half of all publicly traded oil and gas companies are based in the US and Canada (133 and 43 respectively) (Companiesmarketcap.com n.d.). Thus, if petrodollars are being recycled as investments in oil and gas companies, they are likely flowing to OPEC's competitors and to countries that predominantly produce unconventional oil. If this is the case, it is likely prolonging the viability of unconventional oil. Additionally, any investment in oil and gas will naturally reduce investment in, and therefore development of, oil alternatives. This in turn will prolong oil dependence which will intensify depletion, increase costs, and exacerbate the impacts as oil becomes less affordable.

[98] The top ten companies as at 26 January 2023 are: Apple, Saudi Aramco, Microsoft, Alphabet (Google), Amazon, Berkshire Hathaway, Tencent, NVIDIA, TSMC, and Visa (Companiesmarketcap.com n.d.).

Figure 6.7: Origin Country of Largest 100 Global Companies by Market Capitalisation



Source: Companiesmarketcap.com, 'Largest Companies by Market Cap'. URL https://companiesmarketcap.com/, (accessed 26/01/2023)

In the 1970s and 1980s, surplus petrodollars were predominantly attracted by developed economies (IMF 2006; Levy 1974; Shipley 2007; Spiro 1999). This is unlikely to have changed. Figure 6.7 illustrates that of the top 100 global companies (by market capitalisation), 57 are US companies, 13 are Chinese, six are from the UK, and five are French. Collectively, these four countries make up 81 percent of the top 100 companies. There are only two companies in the top 100 that are based in a developing country, Reliance Industries and Tata Consultancy Services, both of which are based in India (Companiesmarketcap.com n.d.). Due to their size, it is likely that the majority of petrodollar investments are still attracted by developed, industrialised countries.

The direction of petrodollar investments will have significant implications in the future. Investments determine which countries' deficits are financed, and shape which companies and sectors develop. While we can only speculate and infer how petrodollars are currently invested, these choices will likely help shape the global political economy over the next few decades. If PIF's investment strategy is reflective of broader petrodollar investments, it would seem likely that the US remains a desirable investment location for surplus petrodollars.

6.3e Summary

There are insufficient data to definitively determine how petrodollars are currently recycled, however certain individual elements can be traced. A portion of petrodollars are consumed by producing more oil. In 2015, approximately 30.45 percent of OPEC's petrodollars were consumed in this manner. OPEC's international arms imports remain high, however their contribution to petrodollar recycling is less significant currently than they were during the 1970s and 1980s. Over the period 2000-2021, only one percent of OPEC's petrodollars were directed to arms imports. Several oil-exporting states are using petrodollars to improve living standards and to diversify their economies in preparation for the post-oil era. While investments are difficult to trace, it is likely that petrodollars are flowing towards the countries and companies with the highest market capitalisation. Based on this, they are likely attracted by developed economies and to sectors including technology, banks/finance, oil and gas, and pharmaceuticals.

6.4 Conclusion

The accumulation of petrodollars must, by necessity, be followed by petrodollar recycling. The methods of recycling petrodollars in the 1970s and 1980s are well documented, as are the detrimental impacts they had on the global political economy. In particular, a significant portion of petrodollars were deposited in US and UK-based banks. These deposits were a liability to the banks, and in order to generate more assets, the banks were incentivised to extend credit through loans. The majority of these loans were extended to developing states and ultimately contributed to the developing worlds' debt crisis.

The contemporary accumulation of petrodollars is a similar volume to that accumulated in the 1970s and 1980s, and the implications of how it is recycled will be significant and far reaching. Despite this, contemporary petrodollar recycling has been neglected by the literature. In this chapter, I posit that petrodollars are likely still recycled in two broad categories: economic channels, such as increased expenditure and imports; and financial channels, such as investments. While specific quantities are obscured, I explored six key methods of petrodollar recycling: oil production costs; increased imports (specifically of weapons); domestic development; economic diversification; acquisition of foreign exchange reserves; and investment in heavily capitalised industries, including the international oil and gas industry. Each of these recycling methods will impact on the global political economy moving into the future, and for this reason, contemporary petrodollar exploration warrants greater academic attention.

Conclusion

This thesis begins to fill a lacuna in the literature by addressing the role of petrodollars in the political economy beyond the early 1980s. The oil price spikes of 1973/4 and 1979/80 triggered an unprecedented accumulation of wealth in oil-exporting states. This transfer of petrodollars resulted in widespread deficits, inflation, and recession. In addition, some of the methods by which the petrodollars were recycled back into the economy caused greater debt, particularly in the developing world. The accumulation of petrodollars in the 1970s and early 1980s is well documented, as are the ramifications of petrodollar recycling over this period. However, to the best of my knowledge, all the literature incorrectly assumes that petrodollar recycling through bank deposits and loans occurred through the practice of fractional reserve banking. This thesis corrects this misconception and demonstrates how these loans were generated through the creation of credit.

For the most part, petrodollars disappeared from the literature in the mid-1980s. This is likely because the price of oil decreased, and petrodollar accumulation decreased in parallel. However, since 1999, a petrodollar transfer on par with that of the 1970s and 1980s has been occurring. The main distinction is that the contemporary increase has been more gradual, whereas the 1970s-1980s' increase was the result of rapid price shocks. There was a brief resurgence of interest in 2006. However, to the best of my knowledge there has been no significant exploration of petrodollar accumulation and recycling over the last 17 years. My thesis updates the literature and creates several key datasets on contemporary petrodollar accumulation:

- Global petrodollar accumulation 1980-2021 (in fixed 2021 USD);
- Global petrodollar accumulation as a percentage of global GDP 1980-2021;
- OPEC petrodollar accumulation 1980-2021 (in fixed 2021 USD);
- OPEC petrodollar accumulation as a percentage of global GDP 1980-2021; and
- Net petrodollars accumulated by the ten largest oil-exporters in 2015 (in fixed 2015 USD).

Due to the vital nature of oil in the global economy, wealth accumulated from exporting oil is likely to only increase in importance. Oil is a crucial input for economic growth and is used in virtually all manufacturing and production. However, its fundamental position within our contemporary civilisational order is best illustrated through three key sectors: petrochemicals, agriculture, and transportation. Our transnational market system which promotes specialisation and division of labour has resulted in a petro-market civilisation where large portions of the population lack the means and knowledge to produce food for themselves. Instead, they are dependent upon large-scale, oil-intensive agriculture and long-distance transportation. While noting that there have been important advances in alternative energy sources, at present there is no viable alternative energy source with the required characteristics to replace the use of oil in these sectors. The continued importance of oil in our petro-market civilisation and the inability of alternatives to replace oil in the petrochemical, agriculture, and transportation sectors in the near future suggests that high global demand for oil will continue. When this is considered in conjunction with peak oil, it is clear that oil prices will continue to increase as resources deplete. This will likely result in a further-escalated transfer of wealth to oil-exporting countries.

Since 1975, the vast majority of oil exports have been denominated in USD. This USD-denomination has been highly beneficial for the US economy and the strength of the USD; effectively maintaining its hegemonic position as the global reserve currency. Over the past few decades, there have been movements towards alternative currency denomination, including Venezuela and Iran in the early 2000s. Any shift to denominate significant portions of global oil exports into another currency is likely to have far reaching political economic implications as it would likely decrease the US' power relative to other dominant economies as the international community attempted to replace their USD reserves with the new denominating currency. More recently, two key exporters – Saudi Arabia and Russia – have begun exploring options to diversify their oil denomination. Of particular note, Saudi Arabia is considering denominating sales to China in yuan. As China is one of the largest global oil consumers (second to the US in 2020), and Saudi Arabia is the largest oil exporter (as of 2020), the impact would be significant. It is too early to extrapolate any meaningful effects from these movements, however, the potential for other exporters to follow Saudi Arabia's lead (particularly OPEC as a unified block controlling 70.1 percent of global oil reserves as of 2020) could severely impact the strength of the USD. Historically, the US has demonstrated a willingness to wage war to protect the role of USD-denomination in the oil industry, however the current involvement of other developed sates (such as China) with strong economies and militaries may act as a deterrent.

Recycling mechanisms throughout the 1970s and 1980s were well documented; petrodollars were recycled through increased imports, investments, and bank deposits. In contrast, the recycling mechanisms of contemporary petrodollars are largely unknown. I argue that two main recycling mechanisms are likely used: economic channels, including increased domestic spending and imports; and financial channels, including investments and purchasing foreign exchange reserves. Each of these mechanisms will have ramifications for the global political economy.

Increasing imports is the most efficient method of correcting trade imbalances. For this reason, oil-importers are incentivised to seek markets in oil-exporting states. An extensive exploration of oil-exporters' imports was beyond the scope of this thesis; however, arms imports was presented as a case study. The key finding was that arms imports to OPEC states remain high, although over recent years they have not increased at the same rate as petrodollar accumulation. While arms imports were a key recycling mechanism in the 1970s and 1980s, since 2000 they have accounted for only one percent of petrodollar recycling.

Tracking of recycling through the financial sector proves difficult due to poor reporting and obfuscation of who invests in sovereign wealth funds. For this reason, while I provide a case study of Saudi Arabia, I predominantly rely on speculation. Commercial investments are most likely attracted to the most heavily capitalised industries: technology, banks/finance, oil and gas, and pharmaceuticals. The direction of petrodollar investments will have far-reaching implications as investments shape which companies and sectors develop, and which do not. Importantly, a portion of petrodollars is likely recycled through investment in the oil and gas industry. One implication of this could be that the industry continues to develop at the expense of alternative energy which will likely have sombre implications for attempts to combat climate change. This would likely prolong oil dependence and result in increased oil prices, further exacerbating petrodollar accumulation.

Recycling through the acquisition of foreign exchange reserves will also have implications moving into the future. Selling exchange reserves to oil-exporting countries is a double-edged sword for oil-importers. On the one hand, there are immediate benefits in that a country's debt is temporarily financed. On the other hand, these debts must be repaid with the addition of interest. Further, the acquisition of significant portions of foreign debt also creates a degree of economic and political leverage for the creditor over the debtor. Oil-exporters likely purchase foreign reserves predominantly from developed economies, as they would be seen as more safe and liquid investments than developing economies. For developing states, this indicates that they will either need to attract increased recycled funds through other mechanisms, or they will experience greater economic hardships. For developed states, this indicates that oil-exporters are likely increasing their relative political and economic position which is particularly significant when one considers that oil-exporters and oil-importers do not necessarily share political and strategic interests.

Contemporary petrodollar recycling has significant implications for the global political economy which have not yet been fully realised. Additionally, as the price of oil continues to escalate, petrodollar recycling will likely have even greater implications moving into the future. It is vital that this topic receives greater academic attention and is researched in more depth to understand what these implications are likely to be.

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Appendices

Appendix 1: Global Petrodollars in fixed 2021 USD

Year	Global Oil Exports (thousand barrels/day)	Days / year	Price / Barrel (fixed 2021 USD)	Global Petrodollars (thousand USD)	Global Petrodollars (billion USD)
1980	32,765.88	366	115.68	1,387,267,255	1,387.27
1981	28,861.41	365	102.30	1,077,671,649	1,077.67
1982	25,693.28	365	88.42	829,252,383	829.25
1983	24,583.73	365	76.79	689,003,620	689.00
1984	24,641.45	366	71.69	646,554,836	646.55
1985	23,280.91	365	66.29	563,303,570	563.30
1986	25,699.10	365	34.08	319,631,262	319.63
1987	25,380.20	365	42.00	389,077,671	389.08
1988	27,074.47	366	32.65	323,533,841	323.53
1989	28,284.42	365	38.04	392,731,084	392.73
1990	29,968.77	365	46.98	513,913,632	513.91
1991	30,388.07	365	38.01	421,552,337	421.55
1992	30,824.13	366	35.64	402,089,612	402.09
1993	31,438.03	365	30.40	348,808,267	348.81
1994	32,358.44	365	27.62	326,254,370	326.25
1995	33,134.17	365	28.90	349,495,437	349.50
1996	34,145.36	366	34.09	426,070,364	426.07
1997	35,721.95	365	30.79	401,421,355	401.42
1998	37,611.76	365	20.19	277,172,762	277.17
1999	36,400.49	365	27.92	370,900,864	370.90
2000	38,867.77	366	42.83	609,250,406	609.25
2001	38,018.47	365	35.72	495,703,542	495.70
2002	37,024.24	365	36.00	486,490,516	486.49
2003	38,678.97	365	40.55	572,516,424	572.52
2004	41,973.98	366	52.43	805,403,992	805.40

2005	43,007.16	365	72.25	1,134,171,188	1,134.17
2006	42,486.14	365	83.63	1,296,902,127	1,296.90
2007	42,913.14	365	90.36	1,415,310,093	1,415.31
2008	42,058.83	366	116.91	1,799,646,677	1,799.65
2009	40,727.64	365	74.40	1,105,975,579	1,105.98
2010	41,403.51	365	94.35	1,425,894,626	1,425.89
2011	41,296.15	365	128.01	1,929,488,911	1,929.49
2012	42,057.19	366	125.88	1,937,665,963	1,937.67
2013	40,850.93	365	120.72	1,799,971,033	1,799.97
2014	40,222.89	365	108.17	1,588,118,231	1,588.12
2015	41,532.28	365	57.20	867,168,300	867.17
2016	44,194.14	366	47.16	762,825,998	762.83
2017	44,699.28	365	57.22	933,546,862	933.55
2018	45,924.95	365	73.50	1,232,015,671	1,232.02
2019	45,249.77	365	65.00	1,073,595,898	1,073.60
2020	42,027.27	366	43.80	673,790,355	673.79
2021	41,227.60	365	70.91	1,067,087,384	1,067.09

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

Appendix 2: Global Petrodollars in nominal USD

Year	Global Oil Exports (thousand barrels/day)	Days / year	Price / Barrel (nominal USD)	Global Petrodollars (thousand USD)	Global Petrodollars (billion USD)
1980	32,765.88	366	36.83	441,676,829	441.68
1981	28,861.41	365	35.93	378,501,504	378.50
1982	25,693.28	365	32.97	309,194,180	309.19
1983	24,583.73	365	29.55	265,153,956	265.15
1984	24,641.45	366	28.78	259,560,248	259.56
1985	23,280.91	365	27.56	234,191,994	234.19
1986	25,699.10	365	14.43	135,355,863	135.36
1987	25,380.20	365	18.44	170,777,994	170.78
1988	27,074.47	366	14.92	147,884,183	147.88
1989	28,284.42	365	18.23	188,163,001	188.16
1990	29,968.77	365	23.73	259,527,268	259.53
1991	30,388.07	365	20.00	221,843,076	221.84
1992	30,824.13	366	19.32	217,970,536	217.97
1993	31,438.03	365	16.97	194,747,497	194.75
1994	32,358.44	365	15.82	186,819,330	186.82
1995	33,134.17	365	17.02	205,799,230	205.80
1996	34,145.36	366	20.67	258,298,295	258.30
1997	35,721.95	365	19.09	248,938,907	248.94
1998	37,611.76	365	12.72	174,564,296	174.56
1999	36,400.49	365	17.97	238,753,700	238.75
2000	38,867.77	366	28.50	405,364,996	405.36
2001	38,018.47	365	24.44	339,201,569	339.20
2002	37,024.24	365	25.02	338,160,449	338.16
2003	38,678.97	365	28.83	407,026,834	407.03
2004	41,973.98	366	38.27	587,845,239	587.85
2005	43,007.16	365	54.52	855,850,922	855.85
2006	42,486.14	365	65.14	1,010,217,761	1,010.22

2007	42,913.14	365	72.39	1,133,851,441	1,133.85
2008	42,058.83	366	97.26	1,497,113,062	1,497.11
2009	40,727.64	365	61.67	916,779,746	916.78
2010	41,403.51	365	79.50	1,201,358,824	1,201.36
2011	41,296.15	365	111.26	1,676,966,227	1,676.97
2012	42,057.19	366	111.67	1,718,924,154	1,718.92
2013	40,850.93	365	108.66	1,620,162,404	1,620.16
2014	40,222.89	365	98.95	1,452,661,431	1,452.66
2015	41,532.28	365	52.39	794,145,646	794.15
2016	44,194.14	366	43.73	707,402,620	707.40
2017	44,699.28	365	54.19	884,162,600	884.16
2018	45,924.95	365	71.31	1,195,342,389	1,195.34
2019	45,249.77	365	64.21	1,060,512,522	1,060.51
2020	42,027.27	366	41.84	643,556,628	643.56
2021	41,227.60	365	70.91	1,067,087,384	1,067.09

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

Appendix 3: Global Petrodollars as a percentage of Global GDP

Year	Global Petrodollars (nominal billion USD)	Global GDP (nominal billion USD)	Petrodollars as percentage of GDP
1980	441.68	11,334.89	3.90
1981	378.50	11,725.86	3.23
1982	309.19	11,608.06	2.66
1983	265.15	11,838.32	2.24
1984	259.56	12,269.79	2.12
1985	234.19	12,860.09	1.82
1986	135.36	15,205.32	0.89
1987	170.78	17,307.24	0.99
1988	147.88	19,338.00	0.76
1989	188.16	20,194.00	0.93
1990	259.53	22,779.98	1.14
1991	221.84	23,759.57	0.93
1992	217.97	25,406.11	0.86
1993	194.75	25,821.98	0.75
1994	186.82	27,872.26	0.67
1995	205.80	31,043.65	0.66
1996	258.30	31,736.66	0.81
1997	248.94	31,620.44	0.79
1998	174.56	31,539.96	0.55
1999	238.75	32,737.37	0.73
2000	405.36	33,830.88	1.20
2001	339.20	33,615.44	1.01
2002	338.16	34,911.43	0.97
2003	407.03	39,146.99	1.04
2004	587.85	44,117.60	1.33
2005	855.85	47,779.71	1.79
2006	1,010.22	51,779.85	1.95
2007	1,133.85	58,355.02	1.94

2008	1,497.11	64,123.70	2.33
2009	916.78	60,809.11	1.51
2010	1,201.36	66,596.05	1.80
2011	1,676.97	73,853.78	2.27
2012	1,718.92	75,488.06	2.28
2013	1,620.16	77,607.20	2.09
2014	1,452.66	79,708.81	1.82
2015	794.15	75,179.27	1.06
2016	707.40	76,465.59	0.93
2017	884.16	81,403.98	1.09
2018	1,195.34	86,413.03	1.38
2019	1,060.51	87,652.86	1.21
2020	643.56	84,906.81	0.76
2021	1,067.09	96,100.09	1.11

Source: BP, Statistical Review of World Energy 2022; OPEC, 'Oil Trade', Annual Statistical Bulletin, 2019, tbl. 5.2; The World Bank, 'GDP (current USD)', Indicator: NY.GDP.MKTP.CD, World Bank Group, [accessed 30/09/2022], https://data.worldbank.org/indicator/NY.GDP.MKTP.CD; calculations are author's own.

Appendix 4: OPEC Petrodollars in fixed 2021 USD

Year	OPEC Oil Exports (thousand barrels/day)	Days / year	Price / Barrel (fixed 2021 USD)	OPEC Petrodollars (thousand USD)	OPEC Petrodollars (billion USD)
1980	21,699.77	366	115.68	918,741,797	918.74
1981	17,468.18	365	102.30	652,253,854	652.25
1982	13,467.72	365	88.42	434,671,779	434.67
1983	11,661.64	365	76.79	326,838,553	326.84
1984	11,089.70	366	71.69	290,977,130	290.98
1985	10,221.40	365	66.29	247,316,403	247.32
1986	12,100.35	365	34.08	150,497,494	150.50
1987	11,424.85	365	42.00	175,142,558	175.14
1988	12,694.82	366	32.65	151,700,187	151.70
1989	14,531.20	365	38.04	201,766,684	201.77
1990	15,731.70	365	46.98	269,772,018	269.77
1991	16,534.02	365	38.01	229,364,815	229.36
1992	17,338.26	366	35.64	226,171,303	226.17
1993	17,802.37	365	30.40	197,519,137	197.52
1994	17,881.13	365	27.62	180,286,651	180.29
1995	18,118.17	365	28.90	191,108,401	191.11
1996	18,471.95	366	34.09	230,495,434	230.50
1997	19,451.38	365	30.79	218,582,740	218.58
1998	20,725.63	365	20.19	152,733,602	152.73
1999	19,438.63	365	27.92	198,068,835	198.07
2000	20,700.06	366	42.83	324,472,444	324.47
2001	19,650.32	365	35.72	256,210,518	256.21
2002	18,033.40	365	36.00	236,955,049	236.96
2003	19,623.84	365	40.55	290,467,085	290.47
2004	22,254.16	366	52.43	427,016,704	427.02
2005	23,424.84	365	72.25	617,752,414	617.75
2006	23,226.51	365	83.63	708,996,107	709.00
2007	23,832.43	365	90.36	786,012,771	786.01

2008	23,544.20	366	116.91	1,007,427,895	1,007.43
2009	21,976.72	365	74.40	596,786,772	596.79
2010	22,780.10	365	94.35	784,523,258	784.52
2011	23,503.21	365	128.01	1,098,145,418	1,098.15
2012	25,098.90	366	125.88	1,156,360,788	1,156.36
2013	23,561.72	365	120.72	1,038,175,013	1,038.18
2014	22,579.91	365	108.17	891,521,519	891.52
2015	23,000.25	365	57.20	480,230,916	480.23
2016	24,603.50	366	47.16	424,675,991	424.68
2017	24,267.23	365	57.22	506,822,337	506.82
2018	24,274.47	365	73.50	651,204,409	651.20
2019	22,477.79	365	65.00	533,307,876	533.31
2020	19,700.56	366	43.80	315,843,627	315.84
2021	19,656.10	365	70.91	508,755,642	508.76

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

Appendix 5: OPEC Petrodollars in nominal USD

Year	OPEC Oil Exports (thousand barrels/day)	Days / year	Price / Barrel (nominal USD)	OPEC Petrodollars (thousand USD)	OPEC Petrodollars (billion USD)
1980	21,699.77	366	36.83	292,508,139	292.51
1981	17,468.18	365	35.93	229,085,608	229.09
1982	13,467.72	365	32.97	162,071,267	162.07
1983	11,661.64	365	29.55	125,779,506	125.78
1984	11,089.70	366	28.78	116,813,133	116.81
1985	10,221.40	365	27.56	102,821,151	102.82
1986	12,100.35	365	14.43	63,731,933	63.73
1987	11,424.85	365	18.44	76,875,382	76.88
1988	12,694.82	366	14.92	69,340,685	69.34
1989	14,531.20	365	18.23	96,669,264	96.67
1990	15,731.70	365	23.73	136,235,333	136.24
1991	16,534.02	365	20.00	120,703,864	120.70
1992	17,338.26	366	19.32	122,606,202	122.61
1993	17,802.37	365	16.97	110,279,375	110.28
1994	17,881.13	365	15.82	103,235,495	103.24
1995	18,118.17	365	17.02	112,533,549	112.53
1996	18,471.95	366	20.67	139,734,144	139.73
1997	19,451.38	365	19.09	135,552,700	135.55
1998	20,725.63	365	12.72	96,192,114	96.19
1999	19,438.63	365	17.97	127,499,480	127.50
2000	20,700.06	366	28.50	215,887,867	215.89
2001	19,650.32	365	24.44	175,320,534	175.32
2002	18,033.40	365	25.02	164,707,888	164.71
2003	19,623.84	365	28.83	206,505,688	206.51
2004	22,254.16	366	38.27	311,669,347	311.67
2005	23,424.84	365	54.52	466,158,882	466.16
2006	23,226.51	365	65.14	552,270,248	552.27

2007	23,832.43	365	72.39	629,700,670	629.70
2008	23,544.20	366	97.26	838,071,983	838.07
2009	21,976.72	365	61.67	494,696,298	494.70
2010	22,780.10	365	79.50	660,984,284	660.98
2011	23,503.21	365	111.26	954,425,168	954.43
2012	25,098.90	366	111.67	1,025,819,995	1,025.82
2013	23,561.72	365	108.66	934,466,218	934.47
2014	22,579.91	365	98.95	815,480,170	815.48
2015	23,000.25	365	52.39	439,791,550	439.79
2016	24,603.50	366	43.73	393,821,015	393.82
2017	24,267.23	365	54.19	480,011,635	480.01
2018	24,274.47	365	71.31	631,820,076	631.82
2019	22,477.79	365	64.21	526,808,720	526.81
2020	19,700.56	366	41.84	301,671,370	301.67
2021	19,656.10	365	70.91	508,755,642	508.76

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; calculations are author's own.

Appendix 6: OPEC Petrodollars as a percentage of Global GDP

Year	OPEC Petrodollars (nominal billion USD)	Global GDP (nominal billion USD)	OPEC Petrodollars as percentage of Global GDP
1980	292.51	11,334.89	2.58
1981	229.09	11,725.86	1.95
1982	162.07	11,608.06	1.40
1983	125.78	11,838.32	1.06
1984	116.81	12,269.79	0.95
1985	102.82	12,860.09	0.80
1986	63.73	15,205.32	0.42
1987	76.88	17,307.24	0.44
1988	69.34	19,338.00	0.36
1989	96.67	20,194.00	0.48
1990	136.24	22,779.98	0.60
1991	120.70	23,759.57	0.51
1992	122.61	25,406.11	0.48
1993	110.28	25,821.98	0.43
1994	103.24	27,872.26	0.37
1995	112.53	31,043.65	0.36
1996	139.73	31,736.66	0.44
1997	135.55	31,620.44	0.43
1998	96.19	31,539.96	0.30
1999	127.50	32,737.37	0.39
2000	215.89	33,830.88	0.64
2001	175.32	33,615.44	0.52
2002	164.71	34,911.43	0.47
2003	206.51	39,146.99	0.53
2004	311.67	44,117.60	0.71
2005	466.16	47,779.71	0.98
2006	552.27	51,779.85	1.07
2007	629.70	58,355.02	1.08
2008	838.07	64,123.70	1.31

2009	494.70	60,809.11	0.81
2010	660.98	66,596.05	0.99
2011	954.43	73,853.78	1.29
2012	1,025.82	75,488.06	1.36
2013	934.47	77,607.20	1.20
2014	815.48	79,708.81	1.02
2015	439.79	75,179.27	0.58
2016	393.82	76,465.59	0.52
2017	480.01	81,403.98	0.59
2018	631.82	86,413.03	0.73
2019	526.81	87,652.86	0.60
2020	301.67	84,906.81	0.36
2021	508.76	96,100.09	0.53

Source: BP, Statistical Review of World Energy 2022; OPEC, 'Oil Trade', Annual Statistical Bulletin, 2019, tbl. 5.2; The World Bank, 'GDP (current USD)', Indicator: NY.GDP.MKTP.CD, World Bank Group, [accessed 30/09/2022], https://data.worldbank.org/indicator/NY.GDP.MKTP.CD; calculations are author's own.

Appendix 7: Petrodollar Profits of Top Ten Oil-Exporting Countries in 2015 in fixed 2015 USD

	Exporter	Price / Barrel (2015 USD)	Production Cost / Barrel (2015 USD)	Profit / Barrel (USD)	Oil Exports (thousand barrels/day)	Days / year	Petrodollar Profits (2015 billion USD)
1	Saudi Arabia	52.39	9.90	42.49	7,163.33	365	111.09
2	Russia	52.39	17.20	35.19	4,899.25	365	62.92
3	Iraq	52.39	10.70	41.69	3,004.88	365	45.72
4	United Arab Emirates	52.39	12.30	40.09	2,441.46	365	35.72
5	Canada	52.39	41.00	11.39	2,301.23	365	9.56
6	Nigeria	52.39	31.60	20.79	2,114.22	365	16.04
7	Venezuela	52.39	23.50	28.89	1,974.18	365	20.82
8	Kuwait	52.39	8.50	43.89	1,963.81	365	31.46
9	Angola	52.39	35.40	16.99	1,710.92	365	10.61
10	Mexico	52.39	29.10	23.29	1,247.08	365	10.60

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; Petroff, A., Yellin, T., 'What it costs to produce oil', CNN Business, 2015, [accessed 13/9/2019], https://money.cnn.com/interactive/economy/the-cost-to-produce-a-barrel-of-oil/index.html?iid=EL; calculations are author's own.

Appendix 8: Production costs and Petrodollar Profits of OPEC in 2015 in fixed 2015 USD

Exporter	Price / Barrel (2015 USD)	Production Cost / Barrel (2015 USD)	Production as percentage of price	Oil Exports (thousand barrels/day)	Days / year	Petrodollars (2015 billion USD)	Production costs (2015 billion USD)	Petrodollar Profits (2015 billion USD)
Algeria	52.39	20.40	38.94	642.21	365	12.28	4.78	7.50
Angola	52.39	35.40	67.57	1,710.92	365	32.72	22.11	10.61
Iran	52.39	12.60	24.05	1,081.15	365	20.67	4.97	15.70
Iraq	52.39	10.70	20.42	3,004.88	365	57.46	11.74	45.72
Kuwait	52.39	8.50	16.22	1,963.81	365	37.55	6.09	31.46
Libya	52.39	23.80	45.43	288.39	365	5.51	2.51	3.01
Nigeria	52.39	31.60	60.32	2,114.22	365	40.43	24.39	16.04
Saudi Arabia	52.39	9.90	18.90	7,163.33	365	136.98	25.88	111.10
United Arab Emirates	52.39	12.30	23.48	2,441.46	365	46.69	10.96	35.73
Venezuela	52.39	23.50	44.86	1,974.18	365	37.75	16.93	20.82
					TOTAL	**428.04**	**130.36**	**297.69**
						Percentage of total Petrodollars	**30.45%**	**69.55%**

Note: There were no available production costs for Ecuador and Qatar and thus they are omitted from this table.

Source: BP, Statistical Review of World Energy 2022; OPEC, Annual Statistical Bulletin, 2022, tbl. 5.2; Petroff, A., Yellin, T., 'What it costs to produce oil', CNN Business, 2015, [accessed 13/9/2019], https://money.cnn.com/interactive/economy/the-cost-to-produce-a-barrel-of-oil/index.html?iid=EL; calculations are author's own.