

OPEC Theater

Does the much-maligned cartel really have the market power it's claimed?

✦ BY DAVID KEMP AND PETER VAN DOREN

There is perhaps no economic indicator more potent in American politics than oil prices. When prices soar, gasoline price hikes are advertised on street corners and felt by consumers at the pump. Plummeting prices aren't great either because they can lead to domestic bankruptcies, layoffs, and the turning of oil field boom towns into ghost towns.

In the scramble to *do something* about oil prices, the ire of the public, media, and politicians is frequently directed toward the Organization of Petroleum Exporting Countries (OPEC). Consisting of 13 member nations accounting for about 40 percent of global crude oil production (including Saudi Arabia, which alone accounts for about 13 percent), the widespread perception of OPEC is that it controls oil prices by changing the amount of oil its members produce.

Last year, for example, OPEC and its allies (10 oil-producing non-OPEC countries including Russia, collectively known as OPEC+) angered U.S. commentators and politicians after announcing a cut in oil production. Through the summer of 2022, amid the Russian invasion of Ukraine, oil prices rose to their highest inflation-adjusted level in nearly a decade, over \$120 per barrel (even though OPEC+ production targets had cumulatively *increased* by more than 2 million barrels per day between December 2021 and May 2022 as the world recovered from COVID). Despite pressure from Western leaders to further increase production, including during a visit by President Biden to Saudi Arabia in July, in October 2022, as oil prices fell to a little over \$90 per barrel, OPEC+ announced a decrease in their targeted production level of 2 million barrels per day.

The move was seen as a snub to the United States and Biden and a decision by Saudi Arabia to align with Russia. Editorials in the *Washington Post* and *Wall Street Journal* criticized Biden, calling the situation a "failure" and a "diplomatic humiliation," while a *New York Times* opinion headline claimed Russian President Vladimir Putin and Saudi Crown Prince Mohammed bin Salman



were “laughing at us.” Though Saudi Arabia claimed the move was purely economic, members of Congress introduced legislation to punish the Saudis by ending arms sales and allowing lawsuits against OPEC for price fixing. The Biden administration said it was going to re-evaluate the U.S. relationship with Saudi Arabia and that there would be consequences.

The whole affair raises questions about what OPEC does and whether the common view of OPEC is correct. The lack of enforcement and frequent cheating on OPEC quotas by members suggests that it is more a political club than an effective oil cartel. In fact, from 1993 to 2022, the production volatility of three key OPEC members—Saudi Arabia, Kuwait, and the United Arab Emirates (UAE), whose production levels are determined by monolithic nationalized oil companies—was rarely different

from that of the United States and its decentralized oil industry.

OPEC membership has less to do with oil production and more to do with geopolitical and domestic political benefits. OPEC nations appear to use oil production as an international bargaining chip to provide the regimes with domestic legitimacy. Politicians in western nations like the United States are more than happy to play into the perceived role of OPEC in oil markets because it provides them with a convenient scapegoat. When oil prices skyrocket—a result that politicians cannot control—they respond by calling on OPEC members to change their production, like rounding up the usual suspects in *Casablanca*.

WHAT CAN OPEC DO?

Popular discourse about OPEC emphasizes quota announcements and market power. Allegedly, OPEC members—especially Saudi Arabia—can decrease or increase oil production in the short term as easily as one would vary water flow from a spigot. Moreover, OPEC nations supposedly could invest in their oil fields and produce more in the long run. But there are some serious problems with this story.

Changing production in the short term? / An oil reservoir is a formation of porous rock where oil has accumulated and is trapped by surrounding non-porous rock. The oil is extracted by drilling into the reservoir and allowing it to flow to the surface, initially driven by natural pressure and then forced to the surface through artificial methods like pumping or injecting water or gas (such as carbon dioxide) into the reservoir.

Petroleum engineers consider various factors, including the oil’s viscosity, the permeability of the rock, and the natural res-

Table 1
Average Core OPEC Capacity Utilization

	2003–2022	2003–2019
OPEC	91.3%	92.3%
OPEC excluding Saudi Arabia	95.8%	97.3%
OPEC excluding Saudi Arabia, Kuwait, and UAE	98.5%	99.5%
Algeria	98.6%	99.9%
Iran	99.5%	99.5%
Iraq	97.9%	99.4%
Kuwait	88.9%	88.9%
Libya	99.9%	99.9%
Nigeria	98.2%	99.4%
Saudi Arabia	83.9%	84.2%
United Arab Emirates	92.5%	96.1%
Venezuela	99.9%	99.9%

Source: Authors’ calculations from EIA, *Short Term Energy Outlook*.
Note: Angola, Congo (Brazzaville), Equatorial Guinea, and Gabon omitted as they were only members of OPEC for portion of 2003–2022. Their exclusion minimally decreases overall OPEC capacity utilization because they are small producers that operate at full capacity close to 100 percent of the time.

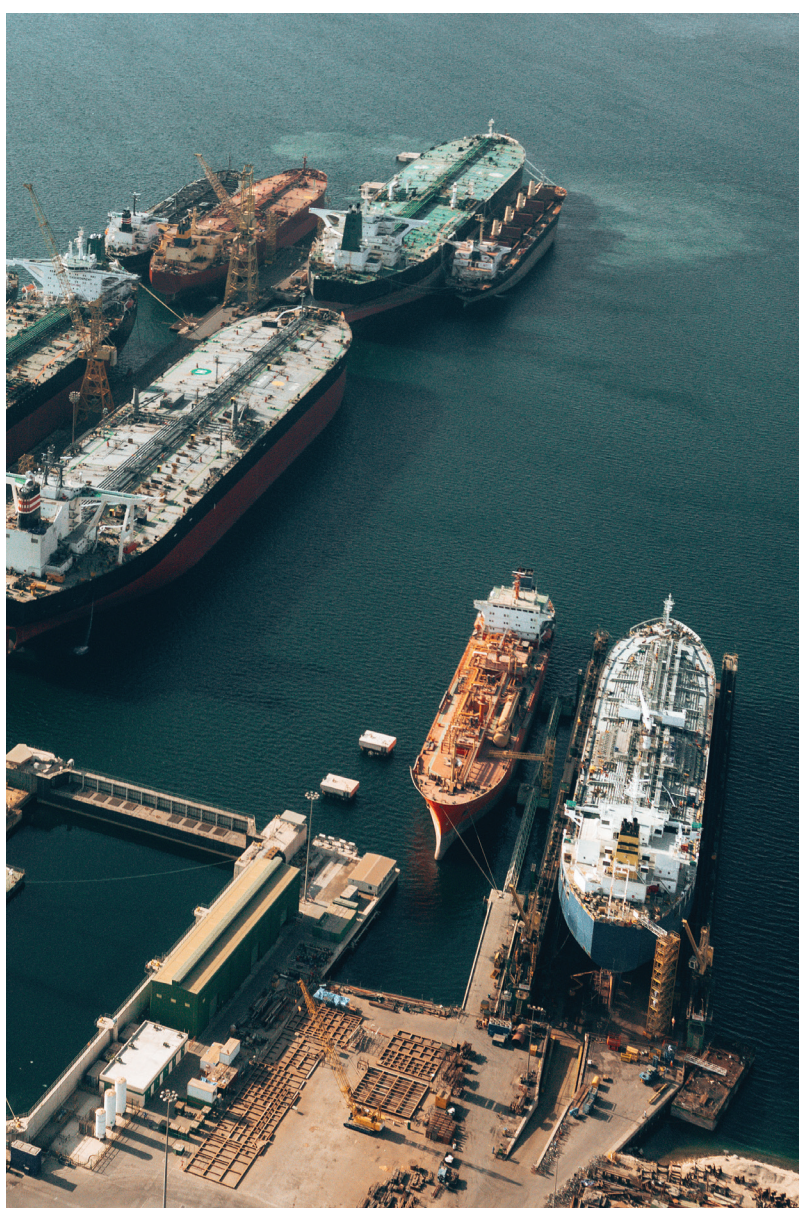


Table 2**Average Difference Between Production and Quota and Compliance for OPEC+ for 1993–2007 and 2017–2022**

OPEC COUNTRIES	Average daily production		Average differences from quota				Months production exceeded quota		Months production exceeded quota by more than 5%		Months production exceeded quota by more than 10%	
	1993–2007	2017–2022	1993–2007		2017–2022		1993–2007	2017–2022	1993–2007	2017–2022	1993–2007	2017–2022
	mb/d	mb/d	mb/d	%	mb/d	%	%	%	%	%	%	%
Algeria	972	978	189	23%	-10	1%	84%	24%	60%	0%	52%	0%
Angola		1,355			-132	-9%		7%		3%		0%
Congo (Brazzaville)		286			-10	-3%		40%		17%		6%
Equatorial Guinea		114			-21	-14%		19%		16%		6%
Gabon		190			12	7%		85%		51%		35%
Iran	3,662	2,752	32	1%	-126	-3%	58%	71%	21%	0%	5%	0%
Iraq	1,608	4,384	37	18%	106	2%	76%	81%	75%	17%	73%	3%
Kuwait	2,129	2,625	140	7%	17	1%	91%	60%	42%	3%	33%	1%
Libya	1,445	896	85	6%			78%		51%		30%	
Nigeria	2,053	1,461	63	3%	-259	-15%	70%	6%	40%	2%	16%	2%
Saudi Arabia	8,441	9,834	327	4%	-123	-1%	96%	38%	29%	4%	8%	1%
UAE	2,244	2,931	61	3%	48	2%	77%	69%	25%	10%	4%	4%
Venezuela	2,708	992	13	2%	-292	-15%	63%	21%	52%	0%	28%	0%
OPEC Average							77%	43%	44%	10%	28%	5%

NON-OPEC COUNTRIES	2017–2022	2017–2022	2017–2022	2017–2022	2017–2022	2017–2022
	mb/d	mb/d	%	%	%	%
Azerbaijan	736	29	5%	70%	37%	27%
Kazakhstan	1,792	107	8%	66%	50%	40%
Mexico	1,810	-141	-6%	43%	14%	0%
Oman	984	108	14%	67%	51%	51%
Russia	10,406	-153	-1%	39%	31%	3%
Non-OPEC average				57%	37%	24%

Source: Authors' calculations. Production allocations for OPEC members are from OPEC and monthly actual production (excluding lease condensate) and total production capacity are from EIA. Except for countries noted, 1993–2007 period includes January 1993 to October 2007 and 2017–2022 includes January 2017 to December 2022. Data for total production capacity are from January 2003 to October 2007 and January 2017 to December 2022. Non-OPEC actual production (including lease condensate) data are from EIA and allocations and sustainable capacity are from IEA oil market reports for 2017–2022. Production and quotas data for non-OPEC nations cover February 2017 to December 2022, while sustainable capacity data cover May 2021 to December 2022.

Notes: Calculations for each country only include months when the country had a production allocation. Because of periods when the country had no quota, Iraq 1993–2007 data are from January 1993 to March 1998, 2017–2022 data for Iran and Venezuela are from January 2017 to December 2018, and 2017–2022 data for Nigeria are from January 2019 to December 2022. Libya had no production allocation for 2017–2022. Angola, Equatorial Guinea, and Congo (Brazzaville) joined OPEC in 2007, 2017, and 2018, respectively. Gabon left OPEC in 1995 and rejoined in 2016 and so is excluded from 1993–2007 period and included in 2017–2022. Additional small non-OPEC members of OPEC+ (Bahrain, Brunei, Malaysia, South Sudan, and Sudan, which together produced roughly 1,000 mb/d in December 2022) are omitted.

ervoir pressure, when they plan reservoir development. Oil wells and reservoirs follow a typical production path: the production rate peaks early, plateaus, and then declines because reservoir pressure drops as oil is extracted. This is known as the “decline curve.” The rate of decline depends on the geological factors and can be moderated with technology (e.g., pumping, injecting water or gas, and enhanced oil recovery techniques) but ultimately cannot be prevented. Because production from individual oil wells and reservoirs declines, simply maintaining a constant rate of oil production requires the drilling of additional wells and the development of new reservoirs, and increasing the rate requires even more drilling and development.

Furthermore, while technology can sometimes be used to

temporarily increase production, prolong an oil field’s production plateau phase, or moderate the decline, it requires additional investment and involves temporal tradeoffs. For example, maintaining a field’s plateaued production level for longer typically leads to a higher rate of decline when the plateau phase finally ends. One extreme case of these tradeoffs is Mexico’s offshore Cantarell field. As Cantarell’s production rate began to decline in the 1990s, Pemex, Mexico’s state-owned oil company, invested in a nitrogen injection project to maintain the reservoir pressure. This brought the field’s production up to a peak of more than 2 million barrels per day in 2004, making it the second most productive field in the world. But production then crashed, reaching an annual decline rate of nearly 14 percent. Recent Pemex reports put the

Months quota exceeded total capacity		Average compliance (production change/ quota change)	
2003–2007	2017–2022	1993–2007	2017–2022
%	%	%	%
0%	43%	24%	64%
	83%		32%
	48%		42%
	69%		-141%
	11%		134%
62%	29%	-19%	
	3%		40%
0%	0%	18%	90%
0%		37%	
36%	73%	48%	-103%
0%	1%	29%	187%
0%	0%	70%	100%
100%	79%	24%	
25%	37%	29%	45%

	2021–2022		2017–2022
	%		%
	75%		67%
	20%		-286%
	100%		-255%
	10%		45%
	50%		44%
	51%		-77%

field's production rate at 160 thousand barrels per day, less than 8 percent of its peak.

Most reservoirs are also “rate-sensitive,” meaning the production rate affects the ultimate amount of oil extracted. Drilling too many wells or allowing wells to produce at too high a rate can cause a quick drop in reservoir pressure, causing some of the oil to be trapped in the reservoir. Drilling too few wells can also reduce output because of friction in the reservoir. Petroleum engineers calculate the number of wells and the rate at which they produce to maximize reservoir lifetime output.

The costs of oil production are largely fixed: the initial capital costs of exploration and development of reservoirs. Once wells are drilled, the marginal operating costs are very low, typically much lower than the price of oil. Thus, most wells produce oil at a rate that maximizes the lifetime output of the reservoir regardless of changes in price. In other words, in most cases, oil production decisions for

existing wells are a binary choice between operating or ceasing production entirely rather than increasing or decreasing their output.

Ceasing production (“shutting in”) involves plugging a well with thick mud and cement. Restarting production requires a drilling rig to remove the cement and pump out the mud. Also, there is a risk that once production is stopped, the porous rock containing the oil will be clogged. A restarted well may not return to the same level of production and may not restart at all.

Finally, not all crude oil is created equal. Different oils from different reservoirs and fields have varying densities and sulfur contents. Refineries are configured with specific crude sources in mind, taking into consideration both dimensions. Any investment into new oil wells or restarting shut-in wells requires consideration of the quality of oil that will be extracted and where and how it will be refined.

Thus, raising and lowering production is much more difficult than OPEC's quota announcements would suggest. Production expansion requires substantial planning and management. In gen-

eral, growing production requires investment in new wells and/or reservoirs rather than increasing the output of existing wells. And that expansion takes time. For example, a Saudi capacity expansion of 1 million barrels per day took four years, from 2005 to 2009.

Investing for the long term? So, oil production from existing wells cannot be easily increased and investment in new capacity takes time. Do producers invest in new capacity ahead of time so that it can be activated quickly when positive demand shocks occur?

Spare capacity has various definitions, but in general it is the difference between a maximum amount of oil production that can be brought online relatively quickly and then sustained for some period and the current oil production level. The U.S. Energy Information Administration (EIA) defines spare capacity “as the volume of production that can be brought on within 30 days and sustained for at least 90 days.” Saudi Aramco, the Saudi state oil company, defines its “maximum sustainable capacity” as “the average maximum number of barrels per day of crude oil that can be produced for one year during any future planning period ... after being given three months to make operational adjustments.”

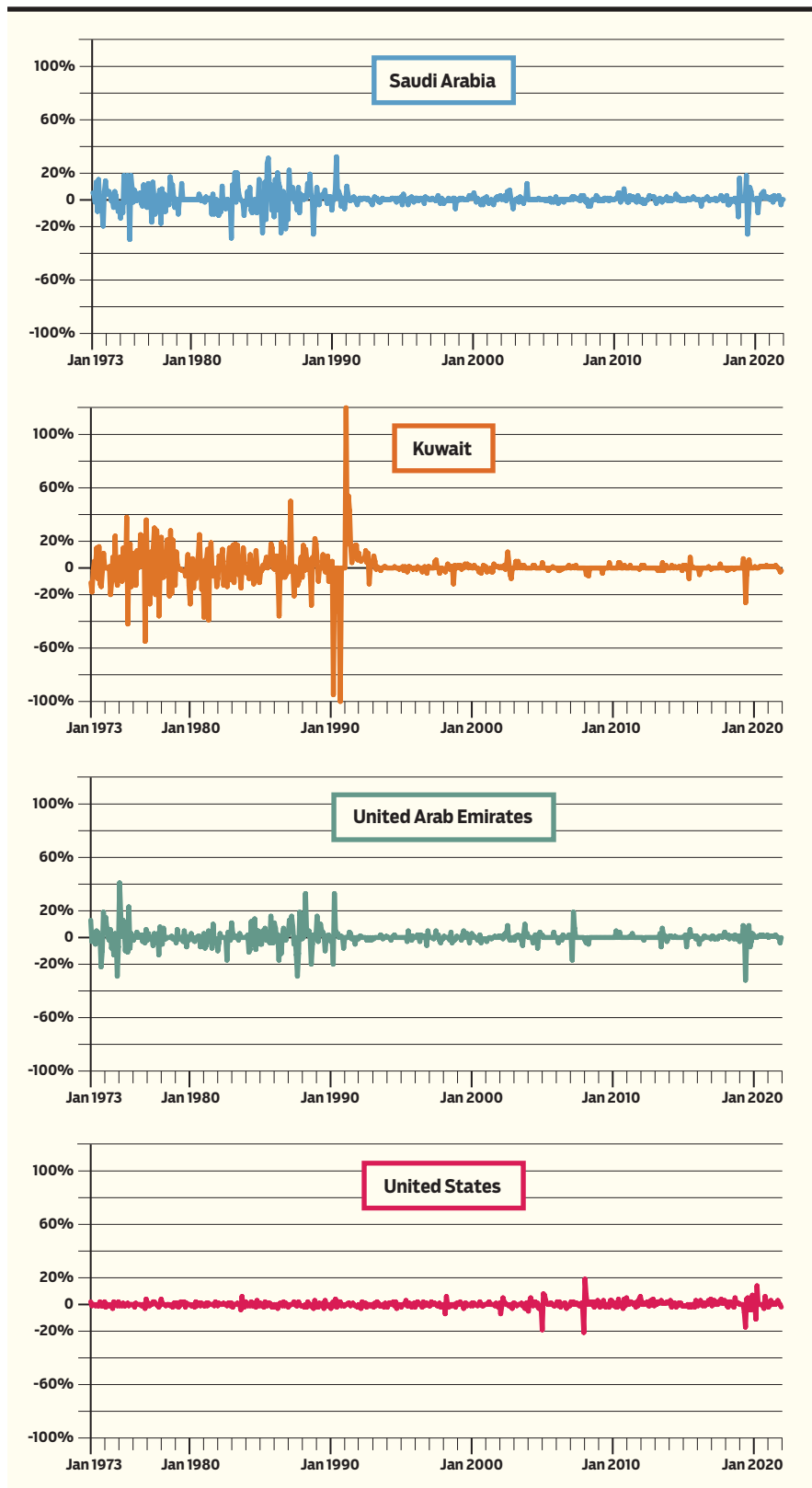
OPEC, especially Saudi Arabia, had spare capacity in the 1980s and 1990s, but it was largely the result of happenstance, not policy choices. Declining oil demand and concurrent increases in non-OPEC supply in the '80s created a large amount of idle OPEC capacity. As oil demand rebounded and the growth in non-OPEC supply slowed in the '90s, OPEC's spare capacity eroded, culminating in a real, binding short-run supply constraint in the mid-2000s caused primarily by rapidly increasing demand from China and India. Since then, there has been little excess capacity.

EIA data suggest that most OPEC nations operate at or near capacity except during periods of political turmoil. Table 1 presents the average capacity utilization (oil production as a percentage of EIA estimated total production capacity) from 2003 to 2022 of nine core OPEC members (nations that were members for the entire period). While Saudi Arabia on average utilized 84 percent of its capacity, OPEC as a whole averaged a utilization rate of roughly 91 percent, OPEC excluding Saudi Arabia averaged nearly 96 percent, and OPEC excluding Saudi Arabia, Kuwait, and the UAE averaged 98.5 percent. Much of the underutilization occurred during the historic drop in world oil demand caused by the COVID-19 pandemic beginning in 2020. During the pre-COVID-19 period 2003–2019, the average capacity utilization of OPEC was roughly 92 percent while the utilization of OPEC excluding Saudi Arabia, Kuwait, and the UAE was nearly 100 percent.

Why is spare capacity so scarce? It is expensive. And as the Saudi 2005–2009 capacity expansion suggests, it takes time to create. But equally important is that if spare capacity existed in the politically unstable Middle East, the incentives for a military takeover of that capacity would increase. According to energy economists Robert Cairns and Enrique Calfucura: “Having excessive capacity may not be prudent.... Making the industry vulnerable to a relatively easy and quick take-over, with overly high levels

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Figure 1
Month-to-Month Crude Oil Production Change, 1973–2022



Source: Authors' calculations based on EIA, International Energy Statistics.

of wealth in developed assets providing overly rich net cash flows, may raise the immediate rewards to revolution.”

WHAT DOES OPEC DO?

So, there are constraints on the rapid change of oil production and on long-run investment in the capacity of OPEC oil fields. The important question for the United States is, given those constraints, how does OPEC behave and how does its behavior affect oil prices?

Our evaluation of OPEC quotas concludes that members' production exceeded their quotas nearly 80 percent of the time and, on average, members adjusted production by less than a third of the allocated reductions or increases. Additionally, for the last 30 years the short-run variation of the oil production of three of the most stable OPEC members, Saudi Arabia, Kuwait, and the UAE, is similar to the United States, implying those nations are not utilizing an ability to rapidly alter oil production.

Quotas and cheating/ Since 1982, OPEC's method of coordination has been to set production allocations, or quotas, for each member. The quotas are adopted at OPEC meetings, typically a few times a year, though quotas were set roughly monthly during the COVID-19 pandemic. The process by which the quotas are decided and the factors considered are opaque, though some evidence suggests that production allocations are linked to each member's production capacity.

There are significant incentives for members to cheat on their quotas. OPEC nations are highly reliant on oil revenues, and producing more oil would allow them to earn more revenue, especially when oil prices are high. And there is little OPEC can do to stop members from cheating. OPEC has no system to monitor oil production by its members and no established mechanism to enforce the production allocations. While Saudi Arabia is traditionally seen as OPEC's enforcer, its only option to punish cheating by other members is to engage in a price war, flooding the world

oil market and ultimately undercutting its own and the rest of OPEC's oil revenues. In the mid-1980s, Saudi Arabia seemed willing to do this to punish excessive cheating, but that has not been the case lately.

Cheating on the quotas is common among OPEC members. Table 2 presents the average difference between production allocations and actual production by OPEC members for two periods, January 1993–October 2007 and January 2017–December 2022. (From November 2007 to December 2016, OPEC published its overall production targets but did not release individual member allocations.) During the earlier period, all the included members of OPEC produced more than their quota on average. And the cheating was frequent and large: members' production exceeded their quotas nearly 80 percent of the time, exceeded their quota by more than 5 percent nearly 45 percent of the time, and exceeded their quota by more than 10 percent nearly 30 percent of the time.

Along with substantial differences between the level of quotas and production, there was also limited adherence to changes in allocated production. The average compliance rate (i.e., the actual production change as a percentage of the change in allocated production in the month the new quota took effect) was 29 percent. OPEC members adjusted production by less than a third of the prescribed cuts or increases.

At first glance, the more recent 2017–2022 period suggests a greater level of adherence to the quotas. However, much of this can be explained by the historic drop in oil demand caused by the COVID-19 pandemic. The low prices reduced members' incentives to cheat on their quotas. And the quotas did not constrain some members' behavior because the quotas exceeded the members' production capacity. Three had quotas that exceeded their production capacity more than half of the months included, and an additional two had quotas that exceeded capacity for more than two-fifths of the time. The six countries that had quotas below their capacity for most of this period produced more than their quota 66 percent of the time, only slightly lower than the overall OPEC average of 77 percent during the 1993–2007 period.

Table 2 also includes the five largest of the 10 non-OPEC countries that constitute the expanded OPEC+ coalition. Starting in late 2016, OPEC has coordinated with these nations and instituted voluntary production allocations to both the OPEC and non-OPEC members. While this would nominally give OPEC more market power, especially through cooperation with Russia (one of the world's largest oil producers), the data suggest minimal adherence by the non-OPEC allies. From 2017 to 2022, these five nations were more likely to overproduce their quotas and had lower levels of compliance.

Thus, cheating by OPEC members is rampant and, crucially, there is little compliance with changes in production levels. Even

if a certain amount of cheating is expected, the fact that there is little attempt to adhere to the size of production cuts and increases undermines any attempt by OPEC to influence oil prices through changes in the amount of oil they supply. Additionally, for long periods, some members have no specific production allocations because of domestic turmoil, war, or sanctions. For example, Iraq had no quota from 1998 to at least 2007, Libya has not had a quota since 2011, and Iran and Venezuela have not had quotas since 2019.

If there has been only limited compliance with the quotas, what purpose do they serve? One theory is that OPEC uses its

Saudi Arabia is seen as OPEC's enforcer, but its only option to punish cheating is to engage in a price war, undercutting its own revenues and those of other members.

production announcements as a signal to financial investors to indirectly control oil prices. Available research on this theory has mixed results and suggests that, at most, the effect of the announcements on price is limited.

Alternatively, the announcement of quotas could be used to support the *perception* that OPEC adjusts oil production to control oil prices. If, as Brown University political scientist Jeff Colgan contends, OPEC is a political club that provides its members with domestic clout and international prestige, then the quotas are the pretense that grants OPEC its perceived power. In that case, the quotas would likely be based on the amount of oil that members intended to produce and OPEC nations would pay little attention to violating the quotas. A case study on Venezuela from 1981 to 2008 found that, instead of being beholden to OPEC directives, the country's oil production followed its own domestic concerns and levels of institutional risk aversion. In fact, in the long-run Venezuela's level of oil production dictated its OPEC quota, not the other way around.

Production and volatility/ Though there is widespread cheating, some observers claim that OPEC utilizes its excess production capacity to adjust production levels to balance world oil markets and affect prices. Conventional wisdom claims that OPEC (especially Saudi Arabia) could increase supply when oil prices are high or decrease supply when they are declining.

OPEC output does vary, but because of political turmoil (e.g., wars in Iraq and civil unrest in Libya, Nigeria, and Venezuela) rather than output management. Over the past several decades, the most politically stable nations, which also have the highest

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estimated levels of excess production capacity, have had production variation similar to production variation in the United States.

Saudi Arabia, Kuwait, and the UAE, relative to other OPEC nations, have been more domestically stable in recent history (excluding the Gulf War, which briefly brought Kuwait production to zero). They are also three of OPEC's largest producers and contain almost all the excess capacity. From 2003 to 2022, in an average month the three members produced 55 percent of total OPEC oil output and held 95 percent of the spare capacity. Saudi Arabia alone accounted for 35 percent of production and 75 percent of the excess capacity.

Figure 1 shows the month-to-month percentage change in production for these three nations and the United States. The variation is much larger from 1973 to 1992. The 1993–2022 period is characterized by monthly production changes mostly close to zero that look similar to the United States.

Table 3 compares the month-to-month and three-month sustained production changes of Saudi Arabia, Kuwait, and the UAE with the United States using a statistical test to determine if they are different. If these OPEC nations alter their production more than the United States, this should be reflected in a *larger* variance of either of these measures relative to the United States.

The variances of Saudi, Kuwaiti, and Emirati oil production were much higher than the United States from 1973 to 2022, but the difference stems from the more distant history of the 1970s and 1980s (and, especially for Kuwait, the 1991 Gulf War). After 1992 the variances of both metrics cannot be statistically distinguished from the U.S. variance. The exception is the one-month production change of Kuwait, which has a statistically different variance from the United States, but also one that is smaller: *its production profile was less volatile*.

The conventional wisdom of exceptional, rapid Saudi (and OPEC) production change is not accurate. The profiles of production change suggest that Saudi Arabia, Kuwait, and the UAE do not behave differently than the aggregate decisions of U.S. producers.

CONCLUSION

Among the chattering classes, OPEC is powerful. It supposedly varies output to inflict pain on western consumers. But the reality is that it faces geological and engineering constraints that limit its ability to vary output from existing wells and reservoirs. Oil production decisions from existing wells are a binary choice between operating or ceasing production rather than increasing or decreasing volume.

OPEC also has limited ability to shape future production by strategically altering the rate of development of new wells and fields. Oil production capabilities are the product of long-term investment decisions in field and reservoir development. OPEC had spare capacity in the 1980s when declining world demand coincided with increased non-OPEC supply, but now OPEC operates with little spare capacity. Oil production has large fixed and low marginal costs. Thus, spare capacity takes time and invest-

Table 3

Comparison of U.S. Variance with Saudi Arabia, Kuwait, and United Arab Emirates

	1973–2022	1993–2022
One month production change		
United States	0.0006	0.0009
Saudi Arabia	0.0037***	0.0009
Kuwait	0.0143***	0.0007**
UAE	0.0031***	0.0009
Three-month sustained production change (EIA spare capacity)		
United States	0.0008	0.0011
Saudi Arabia	0.0061***	0.0012
Kuwait	0.0257***	0.0011
UAE	0.0049***	0.0012

Source: Authors' calculations based on EIA International Energy Statistics, monthly crude oil production (including lease condensate).
Note: Variances of Saudi Arabia, Kuwait, and UAE time series are compared to U.S. series using an F-test. Probability that variances are different from U.S. variance is denoted at 10%, 5%, and 1% confidence level by *, **, and ***, respectively.

ment. In addition, the existence of spare capacity would increase the incentives for political revolution and takeover of an asset that produces immense cash flow relative to marginal costs. If OPEC countries were in a more stable neighborhood, they might invest more in spare capacity, but OPEC is not Texas.

How does OPEC behave given those constraints? Neither OPEC-announced quota levels nor changes in quotas seem to bind. Members exceeded their quotas nearly 80 percent of the time and adjusted production by less than one-third of prescribed quota cuts or increases. OPEC output does vary, but because of political turmoil rather than deliberate short-run output management. After 1992, the conventional wisdom of rapid Saudi (and Kuwaiti and UAE) production change is not accurate.

So, what does OPEC do? It blusters to its citizens to create the appearance of controlling the West. And, in turn, western countries reciprocate by using OPEC as a scapegoat for unpleasant oil supply or demand shocks. It is theater. R

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