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Abstract

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JEL Classification: Q40, Q41, Q43, F40, E32

Keywords: oil price decline, Covid-19 pandemic, macroeconomic implications, supply factors, demand factors, local projections model

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Implications of Cheap Oil for Emerging Markets

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1. Introduction

In March 2020, oil prices collapsed in their steepest one-month decline in half a century, and then fell some more in April. By one measure (the European Brent spot price), the oil price fell by 85 percent between January 22, when the first human-to-human transmission of COVID-19 was announced, and its trough on April 21—more than at the height of the global financial crisis (70 percent from end-August to late-December 2008) and more than the plunge during the whole period of end-June 2014 to mid-January 2016 (77 percent). The West Texas Intermediate oil price fell into negative territory on April 20. This collapse has been attributed to the deep global recession triggered by the COVID-19 pandemic as well as delays in extending the production agreement between OPEC and its partners (Wheeler et al. 2020).

Oil prices have since recovered from their troughs in late April and have returned to just over two-thirds of their January 2020 levels. If they remain at such low levels for the foreseeable future, they could provide a boost to the post-pandemic recovery in energy-intensive manufacturing, agriculture, and transport services. This is especially the case for emerging markets and developing economies (EMDEs). In EMDEs in 2017, agriculture, manufacturing and transport services accounted for 40 percent of GDP in the average EMDE—considerably more than the 26 percent of GDP in the average advanced economy (Dieppe and Matsuoka 2020). These three sectors tend to be particularly energy intensive compared to other economic sectors (Baffes et al. 2015 and Saygina et al. 2011). In addition, by dampening inflation, lower oil prices would also give central banks more room to ease monetary policy (Baffes et al. 2015; Ratti and Vespigniani 2016).[1]

This paper assesses the prospects for such a boost to activity by addressing the following questions. First, how does this most recent oil price collapse compare with previous ones? Second, what has been the macroeconomic impact of similar past oil price collapses?

The paper makes several contributions to an already sizable literature. First, it complements the existing literature on the growth impacts of demand- and supply-driven oil price shocks by using a different approach.[2] The literature thus far has relied on various coefficient restrictions and other identification schemes in structural vector autoregressions (SVAR) to identify demand and supply-driven shocks. Generally, the literature has found that supply-driven oil price increases are associated with declining

[1] Depending on the source of the fall in oil prices, it may also depress equity markets (Kang, Ratti, and Vespigniani 2016).

[2] There are also several studies that estimate the impact of oil price shocks without formally distinguishing their origins (Abeysinghe 2012; Blanchard and Gali 2010; Cologni and Manera 2008; Tang, Wu and Zhang 2010; Feldkirchner and Korhonen 2012; Wu, Li, Zhang 2013; Herrera and Pesavento 2009; Ramey and Vine 2011; Mohaddes and Pesaran 2017; Herrera and Rangaraju 2010; Jimenez-Rodriguez and Sanchez 2005; Du, He, and Wei 2010).

activity whereas demand-driven oil price increases are associated with rising activity, albeit often with weaker effects (Baumeister and Hamilton 2019; Cashin, Mohaddes, Raissi and Rassi 2014; Peersman and Van Robays 2012; Kilian 2009; Lippi and Nobili 2012; Aastveit, Bjørland, and Thorsrud 2015). This paper tackles a similar question but in a narrative approach which explicitly isolates episodes of large oil price collapses. It distinguishes oil price collapses since 1970 by their main sources and estimates their impact on growth in a local projections model. This approach is much closer to a natural experiment than the identification schemes used by previous studies that often relied on ad hoc assumptions.

Second, this paper focuses on emerging markets and developing economies (EMDEs) whereas most of the previous literature has restricted itself to advanced economies. Baumeister and Hamilton (2019); Baumeister and Peersman (2013); Kilian (2009); and Kilian and Murphy (2014) estimate the impact of oil demand and supply shocks on U.S. output in vector autoregression approaches. Kanzig (2019) and Lippi and Nobili (2012) extend these exercises to U.S. industrial production and Anzuini, Pagano and Pisani (2015) to a monthly U.S. activity index. Peersman and Van Robays (2012) extend these estimations to broader samples of predominantly advanced economies. Few studies include EMDEs at all and even those that do include only about a dozen large EMDEs (Caldara, Cavallo, and Iacoviello 2019; Mohaddes and Raissi 2019; Aastveit, Bjørland, and Thorsrud 2015; Cashin, Mohaddes, Raissi and Rassi 2014).

Yet, the impact of oil price swings might well be expected to be larger for EMDEs than for advanced economies. EMDEs are almost twice as energy intensive as advanced economies (**Figure 1**). Almost one-quarter of EMDEs rely heavily on energy exports and another one-fifth of EMDEs rely heavily on agricultural exports, which are themselves highly energy intensive. Hence, this paper relies on data for the largest EMDE sample yet (153 EMDEs).

Third, this paper focuses on the impact of steep oil price collapses. Such oil price collapses allow for asymmetric and nonlinear effects to emerge. This contrasts with previous studies that relied on vector autoregressions without distinguishing between oil price increases and decreases nor between large and small oil price changes. Yet, Hooker (1996), Davis and Haltiwanger (2001), Hamilton (2003), and Jimenez-Rodriguez and Sanchez (2005) show that the impact of oil price changes may not be symmetric: in advanced economies, oil price increases can cause just as much damage to output as oil price collapses. A few studies adopt nonlinear frameworks capable of capturing the asymmetric relationship between oil prices and economic activity which seems evident with large oil price shocks.[3] However, all these studies focus on the U.S. economy.

The paper reports several findings. First, it documents that the oil market disruptions of

[3] See for example An, Jin, and Ren (2014) and references therein.

March and April 2020 were record-breaking in multiple dimensions. A record-steep oil price collapse was accompanied by a record-steep oil demand collapse. Although April brought an agreement on historically exceptionally high oil production cuts, these cutbacks fell well short of the decline in demand.

Second, most of the previous six oil price collapses since 1970 have been associated with global recessions or global slowdowns, and the most recent one is no exception. These oil price collapses were marked by sharp slowdowns in oil demand and modest cuts in oil production. Conversely, the two oil price collapses that were not associated with global recessions (1985-86 and 2014-16) were accompanied by surging oil production from new producers and, based on limited available data, modestly slowing oil demand.

Third, none of the oil price plunges since 1970 have been accompanied by rising activity, notwithstanding the boon to energy-intensive activity and the relaxation of constraints on monetary policy. This has reflected, in some cases, their demand-driven nature (Cashin, Mohaddes, Raissi, and Raissi 2014; Kilian 2009; Peersman and Van Robays 2012); more generally, the timing of losses that tend to be frontloaded and gains that tend to be backloaded (de Michelis, Ferreira, and Iacovelli 2020); and the asymmetries created by uncertainty, frictions, and asymmetric monetary policy responses that increase the damage to energy exporters compared with the benefits to energy importers.[4]

Fourth, the paper confirms the findings of the earlier literature and extends it to EMDEs: supply-driven oil price collapses tend to be associated with significant output losses in energy-exporting EMDEs several years after the collapse without being associated with meaningful output gains in other EMDEs. In part, this reflects the persistence of supply-driven oil price collapses. Even four years after the collapse, oil prices were still one-third below their pre-collapse peak. Such long-lasting shocks erode fiscal revenues and external reserves, weaken current account balances and exchange rates, discourage investment, and lower total factor productivity in resource-rich countries (Aguiar and Gopinath 2007; Dreschsel and Tenreyro 2018; Kose 2002). In contrast, demand-driven oil price collapses were not robustly associated with significant gains (or losses) in either group of countries.

The next section 2 documents the past seven oil price plunges in detail. The subsequent section 3 discusses the methodology and data used to estimate the impact of these plunges on EMDE output. Section 4 provides the results and Section 5 concludes.

2. Past oil price collapses

2.1 Episodes

Since 1970, the global economy has witnessed seven oil price plunges when the unweighted

[4] See Hamilton (2011); Hoffman (2012); Jimenez-Rodriguez and Sanchez (2005); and Jo (2014).

average of Brent, Dubai and West Texas Intermediate oil prices, as reported in the World Bank's *Pink Sheet*, fell by 30 percent or more over a six-month period: 1985-86, 1990-91, 1997-98, 2000-01, 2008-09, 2014-16, and 2020.[5] All but two of them (1985-86, 2014-16) were associated with global slowdowns or recessions as reported by Kose, Sugawara, and Terrones (2020). Most of these collapses were accompanied by weakening global growth, which contributed to the decline in oil prices, and were followed by slow recoveries. Several were accompanied or followed by financial market strains.

The March and April 2020 oil price collapses were the steepest one- and two-month collapses on record. Global oil demand collapsed as a result of the steepest global recession since the second world war as well as the wide-spread restrictions on transport and travel, which account for about two-thirds of global oil demand, to stem the spread of the COVID-19 pandemic (Wheeler et al. 2020). Meanwhile, a production agreement between OPEC and its partners, especially Russia, was delayed in early March before being concluded in mid-April with an agreement to historically large production cuts. These production cuts, however, still fell well short of the collapse in demand (World Bank 2020a, b). As a result, OECD petroleum inventories reached near-record highs. Once pandemic-related restrictions on economic activity were relaxed, oil prices rebounded quickly. Within three months, by June 2020, oil prices had recovered most of their losses and had returned to two-thirds of their pre-plunge levels.

2.2 Evolution of oil prices during oil price collapses

This section compares the seven episodes of price collapses against the pre-collapse price peak and the subsequent recovery. The collapse is identified as the earliest month in a string of months in which prices collapsed by more than 30 percent over a six-month period. The pre-collapse price peak (t=0) is defined as the month with the highest price in the twelve months preceding the month that identifies the price collapse.[6] The amplitude, duration and speed of the price collapse is defined by the pre-collapse price peak and the trough of the price in the collapse. The price recovery is the period in which prices reverse at least half their cumulative losses from the pre-collapse peak to their trough in the collapse. The pre-collapse runup is defined as the pre-collapse trough in prices to the pre-collapse price peak, in practice never more than a period of twelve months. **Table 1** shows the amplitude, duration and speed of the price collapses, as well as their runups and recoveries, thus defined.[7]

[5] The global economic developments around the collapses before 2020 are described in greater detail in Baffes et al. (2015); Baumeister and Kilian (2016); Kilic Celik, Kose, and Ohnsorge (2020); Kose and Ohnsorge (2019); Stocker et al. (2018); and World Bank (2018).
[6] Pre-collapse peaks are defined as November 1985 (1986 episode), October 1990 (1991 episode), October 1997 (1998 episode), September 2000 (2001 episode), July 2008 (2009 episode), June 2014 (2014 episode), and December 2019 (2020 episodes).
[7] The data is plotted in Supplemental Annex Figure 1.

All price collapses were preceded by runups in oil prices, at a pace of 0.7 to 31.5 percent per month, in almost all cases accompanied by rising demand. In this runup, the 1991 price collapse stands out: in the four months preceding their collapse, oil prices more than doubled. This pre-collapse price surge reflected a spike in geopolitical risk triggered by Iraq's invasion of Kuwait and the subsequent first Gulf War in August 1990. The 1991 price collapse was largely an unwinding of this risk-related price surge: within eight months, as the first Gulf War drew to a close, oil prices had shed most of their gains and returned to near pre-war levels. They did not regain even half their losses from the peak for several years.

The 2020 price collapse was by far the steepest of the seven episodes but also the shortest-lived. Oil prices collapsed by one-third per month (even steeper than the 2009 collapse) but, within four months (one month earlier than after the 2009 collapse), had troughed and begun to recover. By July 2020, oil prices were within a whisker of recovering half their losses from end-2019, making the recovery the fastest of any oil price collapse since 1970. Supply-driven oil price collapses were longer-lasting the supply-driven ones: four years after the collapse, oil prices were still at most two-thirds their pre-collapse peak. This contrasts with demand-driven collapses (with the exception of the 1990-91 episode) where prices had recovered two about 90 percent of their pre-collapse peak within two to three years. Meanwhile, being largely an unwinding of an earlier geopolitical risk premium, the 1991 oil price collapse stands out as the most gradual of the seven episodes and as lacking a full recovery. Collapses associated with global slowdowns (1998, 2001) were less deep than those associated with global recessions (1991, 2009, 2020).

2.3 Evolution of oil demand, supply and inventories during oil price collapses

Table 2 shows the largest demand declines and supply and inventory increases during the period of the price collapse.[8] For the period in which prices reversed at least half their losses, the table shows the largest increases in demand, supply and inventories per month.

All price collapses with available data were associated with a decline in oil demand. The slumps in oil demand were pronounced in global recessions (2009, 2020) and slowdowns (2001, 1998) but negligible in the collapse of 2014-16 that was associated with a shift in OPEC policy.[9] A recovery in demand accompanied the subsequent recovery in prices but

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[8] Arithmetically, since demand and supply fluctuate from month to month, one could also consider the largest demand increases and the largest supply reductions during the price collapse. However, in almost all episodes with available data (except 2000 when an initial increase was subsequently reversed), demand increases were much shallower or occurred considerably later than demand declines. Hence, demand declines are apparently the prevailing feature of price collapses. For supply, the collapse of 2014-16 was associated with supply expansions and, in the other collapses, either followed a supply increase or were quickly reversed.

[9] Monthly data is unavailable before 1997. Annual data suggests that global oil demand fell by less than 1 percent in 1990 and 1991 and by less than 3 percent in 1985 and 1986.

in several cases at a considerably slower pace than the demand decline during the oil price collapse.

Almost all of the seven episodes (except 2009) were accompanied by prolonged increases in oil supply. However, the supply increases were particularly pronounced in the two episodes associated with a shift in OPEC policy (1985-86, 2014-16). In addition, the 1985-86 collapse was also preceded by several months of rapidly rising supply while the 2014-16 collapse was preceded by rapidly rising U.S. oil production offset by rapidly falling OPEC oil production (Baffes et al. 2015). The 1991 oil price correction was immediately preceded by the rapid recovery in OPEC production recovered from the initial disruptions caused by the first Gulf War.

As a result of the demand collapse and, at most, modest supply reductions, inventories grew rapidly through all oil price collapses except the 1991 collapse when oil inventories were drawn down during the first Gulf War and did not return to pre-war levels for several years. The inventory buildup was steepest in the collapse of 2014-16, reflecting a deliberate OPEC policy shift, and in 2020, reflecting the sheer speed of the demand decline.

Based on the sizable expansion in supply in the 2014-16 and 1985-86 episodes—in both cases reflecting shifts in OPEC decisions about production, the negligible decline in demand, these two episodes are considered predominantly supply-driven episodes. The other episodes are considered predominantly demand-driven. The distinction based on this event study is supported by econometric estimates. In a Bayesian vector autoregression, Wheeler et al. (2020) estimate that oil price collapses in 1998, 2001, and 2008-09 were one-half (1998) to entirely (2008-09) demand-driven, whereas the oil price plunges of 1985-86 and 2014-16 were four-fifths and two-thirds supply-driven, respectively.[10] The collapse of 1991 was about two-fifths demand-driven.

3. Macroeconomic impact of oil price collapses

3.1 Macroeconomic developments following past collapses

These oil price collapses have been associated with a wide range of macroeconomic outcomes, consistent with the literature. Based on vector autoregression models, existing studies find wide ranges of impacts of oil price collapses or spikes on macroeconomic outcomes. These studies include Aastveit, Bjørland, and Thorsrud (2015); Baumeister and Hamilton (2019); Baumeister and Peersman (2013); Cashin, Mohaddes, Raissi, and Raissi (2014); Killian (2009); Kilian and Murphy (2014); Mohaddes and Raissi (2019); and Peersman and Van Robays (2012). In summary, these studies find that a demand-driven 30 percent oil price decline reduces output by 0-5 percent over a year or two, an similar

[10] Other estimates put the share of supply factors in the 2014-15 collapse at just under half (Baumeister and Hamilton 2019).

oil-specific demand decline reduces output by 0.3-4 percent over a year or two, and a similar supply-driven oil price decline reduces output by 0-15 percent over a year or two.

Demand-driven oil price collapses were associated with several years of below-trend global and advanced-economy growth (**Figure 2**).[11] On average, global and advanced-economy output was still 2 percent below the pre-collapse trend five years after the oil price collapse. The exception was the oil price collapse of 2000-01, which occurred during a brief U.S. recession followed by a rapid rebound that was fueled by policy easing. During demand-driven oil price collapses, EMDE output often returned above-trend within three years and, on average, reached almost 3 percent above trend levels five years after the oil price collapse.

In contrast, supply-driven oil price collapses were associated with a subsequent period of above-trend global and, especially, advanced-economy growth.[12] That said, supply-driven oil price collapses had adverse repercussions for EMDEs and, especially, energy-exporting EMDEs. At best (in the 1985-86 collapse), EMDE output hovered around trend, mainly because some large energy importing EMDEs continued to grow robustly. However, in the supply-driven collapse of 2014-16, growth slowed below trend even in large non-energy-exporting EMDEs. This was particularly the case for China, which by 2014 had grown to account for about 7 percent of global GDP, and was implementing a deliberate policy to guide investment towards more sustainable levels (Wheeler et al. 2020). Energy-exporting EMDEs, meanwhile, suffered several years of severely below-trend output after supply-driven oil price collapses.

3.2 Empirical methodology and data

The cumulative responses of real output (real GDP) growth at horizon h—denoted by $y_{t+h,j}$—following oil price collapses are estimated using the local projection method of Jordà (2005), with the adjustment developed by Teulings and Zubanov (2014). The model is given by

$$y_{t+h,j} = \alpha_{(h),j} + \beta_{(h)} E_{t,j} + \sum_{s=1}^{p} \delta_{(h),s}\, y_{t-s,j} + u_{(h)t,j}. \qquad (1)$$

where $h = 0, 1, 2, \cdots, 5$ is the horizon, $\alpha_{(h),j}$ is country j fixed effects, and $u_{(h)t,j}$ is an error term. The coefficient of interest $\beta_{(h)}$ captures the dynamic multiplier effect (impulse response) of the dependent variable with respect to the event dummy variable $E_{t,j}$. The number of lags for each variable is denoted by p and set to 1 for the estimation. The specification controls for lagged dependent variables $y_{t-s,j}$. Robust clustered standard errors are used, one lag of the dependent variable to deal with degrees-of-freedom

[11] Figure 2 compares actual output with a counterfactual in which output would have continued to growth at the average growth rate of the decade preceding the event.
[12] Mohaddes and Raissi (2019) find similar results using a global SVAR with sign restrictions.

constraints.[13]

For the annual dataset used in this regression, the event years are defined as the years of the onset of the oil price collapse from its pre-collapse peak (1985, 1990, 1997, 2000, 2008, and 2014). The results are robust to defining them based on the year in which oil prices bottomed out. For the baseline results, only the oil price collapses of 1985 and 2014 are considered supply-driven, the other results are considered demand-driven. The robustness of the results to this assumption is tested in the robustness section.

The regression sample includes 153 EMDEs for 1970-2018, of which 34 EMDEs are considered energy exporting (oil, gas, or coal), defined as in World Bank (2020b). Annual data on real GDP are available from the World Bank' *World Development Indicators*.

3.3 Baseline results

The model estimates the response of EMDE output to the six oil price plunges before 2020 over the following five years. It distinguishes between demand-driven (1990-91, 1997-98, 2000-01, 2008-09) and supply-driven oil price plunges (1985-86, 2014-15). **Table 3** presents the results.

Oil price collapses were associated with significant EMDE output losses up to five years after the collapse (**Table 3, first column**).[14] The output response in the first year was insignificant, reflecting the fact that all oil price collapses straddled the turn of a year. However, from the following year, when oil prices reached their trough, the effect becomes statistically significantly negative. Five years after the oil price collapse, EMDE output was still 2.7 percent below baseline.

These output losses associated with oil price collapses were broad-based, affecting both energy-exporting and other EMDEs to broadly similar degrees. To test for differential impacts on energy-exporting and other EMDEs, a dummy for energy exporter status and an interaction term between this dummy and the oil price collapse dummy are added (**Table 3**, **last three columns**). The main coefficient on oil price collapses, which now reflects the output response of non-energy-exporting EMDEs, remains statistically significantly negative; the coefficient on the interaction term, which reflects any differential impact in energy-exporting EMDEs, is statistically insignificant until the last year. The overall response of EMDE energy exporters' output to oil price collapses is statistically significantly negative (as the probability of the corresponding F-test shows in the **last column of Table 3**).

[13] This is also consistent with Ramey and Zubairy (2018) who use four lags for quarterly data, i.e. also one year.

[14] Note that the coefficients reported in different tables are cumulative impulse responses. Hence, they already take into account any rebound in prices and economic activity that has taken place during the forecast horizon.

A closer look at the sources of oil price collapses, however, reveals that output losses associated with oil price collapses were unevenly distributed depending on the source of the oil price collapses. The role of demand-driven versus supply-driven oil price collapses is examined by replacing the single dummy for all oil price collapses with two dummies, one for demand-driven oil price collapses and one for supply-driven collapses.[15] These two dummies are again interacted with the dummy for energy exporter status. The results are shown in **Table 4**.

In non-energy-exporting EMDEs, supply- and demand-driven oil price collapses were not associated with robust, statistically significant output losses (**Table 4**). The coefficients on the dummies for supply-driven and demand-driven oil price collapses now capture the response of output in these other EMDEs that do not rely heavily on energy exports. This response is statistically insignificant for supply-driven oil price collapses, consistent with the global economy's expansion at an above-trend pace following these collapses (**Figure 2**). The apparently statistically significant output losses in non-energy-exporting EMDES following demand-driven oil price collapses, however, reflected developments after the 1990-91 collapse. The robustness exercises in section 3.4.1 below indicate that, excluding this episode, there was no statistically significant impact. Possibly, any growth gains in energy importers resulting from cheap oil were gradual and delayed (de Michalis, Ferreira, and Iacovelli 2020).

Conversely, in energy-exporting EMDEs, supply-driven oil price collapses—and eventually demand-driven oil price collapses—were associated with severe and lasting output losses. The coefficient estimates on the interaction term with the dummy for demand-driven oil price collapses suggest that the response of output in energy-exporting EMDEs in these episodes did not differ statistically significantly from that of other EMDEs. In fact, after demand-driven oil price collapses, the overall output responses in energy-exporting EMDEs was initially statistically insignificantly different from nil. This may reflect their greater ability to deploy fiscal and monetary policy stimulus to support their economies through global recessions and slowdowns (Auerbach and Gorodnichenko 2012; Kose, Sugawara, and Terrones 2020). In contrast, the response to supply-driven oil price collapses was statistically significantly more severe in energy-exporting than in other EMDEs. Five years after a supply-driven oil price collapse, output in energy-exporting EMDEs was still 9 percent below the baseline.[16] Such lasting losses may have reflected a reassessment of long-term growth prospects of energy exporters in supply-driven oil price drops.

[15] Note that constants are omitted in all regressions.

[16] This is consistent with Mohaddes and Raissi (2019) who find that a U.S. oil supply-driven shock, equivalent to a 10-12 percent drop in oil prices, generates lasting output losses in the Gulf Cooperation Council (GCC) countries of just over 2 percent.

3.4 Robustness tests

3.4.1 Reclassification of episodes

For robustness, the estimation is repeated with a different classification of events. First, the oil price collapse of 1990-91 is dropped from among the demand-driven oil price collapses since it reflected largely a rapid unwind of an earlier spike in the geopolitical risk premium around the first Gulf War. It turns out that the 1990-91 episode was followed by such severe EMDE output losses that it determines the overall impact of demand-driven collapses. Excluding the 1990-91 episode, demand-driven oil price collapses (just like supply-driven oil price collapses) were no longer associated with lasting output losses in non-energy-exporting EMDEs. However, supply-driven output collapses continued to be associated with lasting output losses in energy-exporting EMDEs (**Supplemental Annex Table 1**).

Second, all oil price collapses straddled the turn of a year, beginning in the second half of one year and bottoming out in the subsequent year. Hence, in a robustness exercise, the event year is defined as the year in which oil prices troughed instead of the year in which the oil price collapse began. The main results are robust to these changes, as shown in **Supplemental Annex Table 2**: Oil price collapses are associated with lasting EMDE output losses; output losses in EMDE energy exporters tend to be particularly pronounced after supply-driven oil price collapses. As expected, the shift in the event year strengthens the magnitude and significance of the coefficients in the first year.

3.4.2 Lag structure and subsamples

The baseline regression chooses the single lag for the dependent variable to avoid the loss of degrees of freedom associated with models using annual data. However, the growth process may be more persistent. The results are broadly robust to using two lags, as shown in **Supplemental Annex Table 3.** Again, the results are consistent with the baseline results, but the response of non-energy-exporting EMDEs to demand-driven oil price collapses—anyways a somewhat fragile result—dissipates faster than using a single lag.

By testing for differential effects for groups of oil price collapses or groups of countries using dummy variables, the estimation assumes that all other coefficients are common across groups. This assumption can be relaxed, albeit at the cost of a loss of precision, by conducting the estimation for subsamples of oil price collapses and of countries. The results of such subsample estimations are shown in **Supplemental Annex Tables 4 and 5.** The main results are consistent with the baseline results discussed above.

4. Conclusions

The restrictions imposed to stem the COVID-19 pandemic and the global recession triggered by its outbreak have been accompanied by an unprecedented collapse in oil demand and prices. Based on past experience, this oil price collapse is unlikely to provide much of a sustained buffer for global growth. This paper shows that past demand-driven oil price collapses did not materially lift EMDE growth, not even in energy-importing EMDEs.

If anything, the preceding oil price collapse in 2014-15 eroded energy-exporting EMDEs' ability to support their economies through the 2020 collapse (Wheeler et al. 2020). Being largely supply-driven, the 2014-15 collapse was considerably more damaging to EMDE energy exporters than demand-driven collapses. Many implemented large-scale fiscal stimulus and drew down reserves in an effort to dampen the immediate impact on their economies. This left them in a more vulnerable position when the 2020 collapse struck. Their ability to emerge from the 2020 oil price collapse with as little lasting damage as in past demand-driven collapse may depend on their continued ability to muster policy support. Greater economic and fiscal diversification may also help dampen the impact of oil price plunges.

This paper was premised on the assumption (in line with a literature based on advanced economies) that oil price plunges have asymmetric effects on economic activity in EMDEs that warrant their separate estimation. Future research could test these assumptions more explicitly in a parallel exploration of oil price surges.

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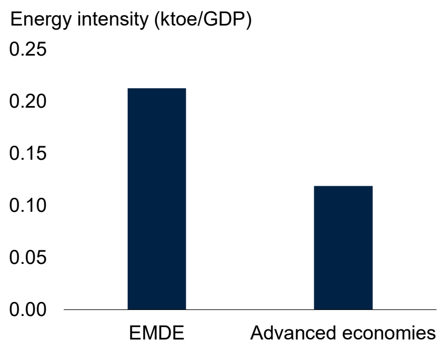
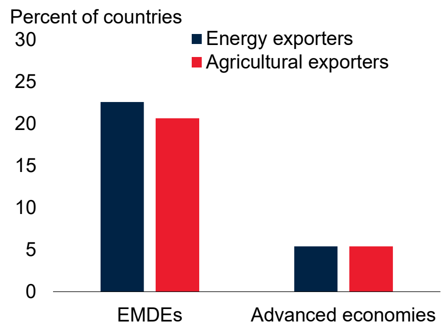
Figures and Tables

Figure 1. Energy reliance of EMDEs and advanced economies

A. Energy intensity



B. Energy- or agricultural goods-exporting countries



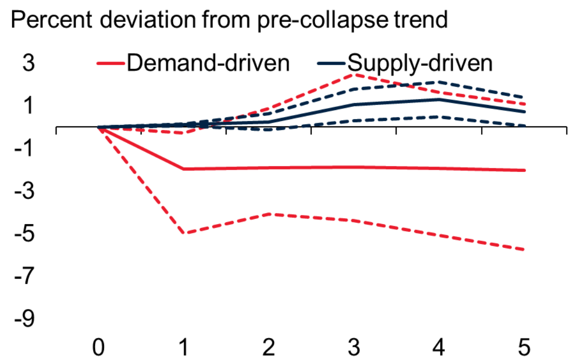
Sources: Energy Information Administration; World Bank.

A. Measured as total final consumption (kilotonnes per energy unit) relative to U.S. dollar GDP (at market exchange rates). Unweighted averages for emerging markets and developing economies (EMDEs) and advanced economies. 2017 data (latest available).

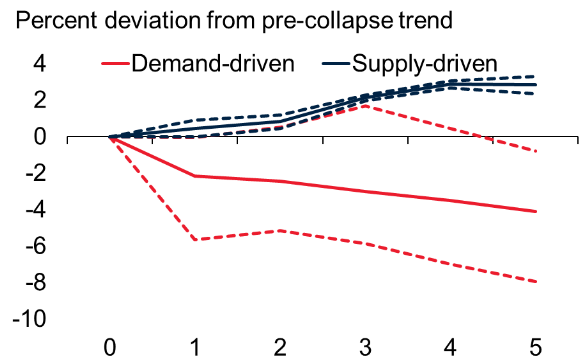
B. Percent of EMDEs or advanced economies that are energy exporters or agricultural commodities exporters, as defined in World Bank (2020).

Figure 2. Output following oil price collapses

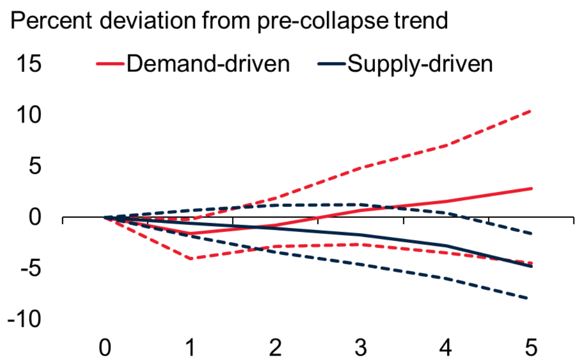
A. World



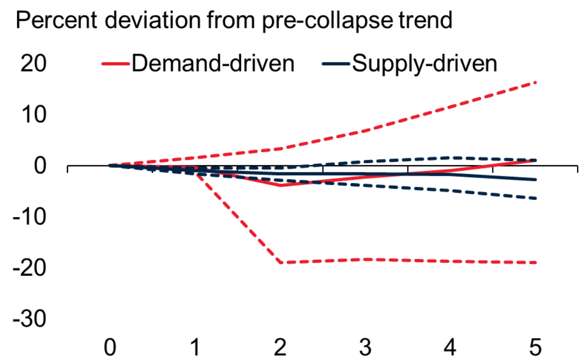
B. Advanced economies



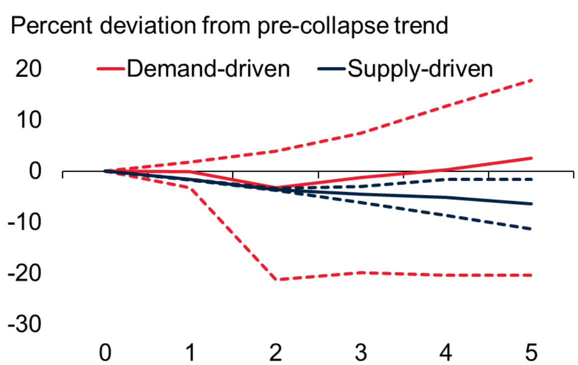
C. EMDEs



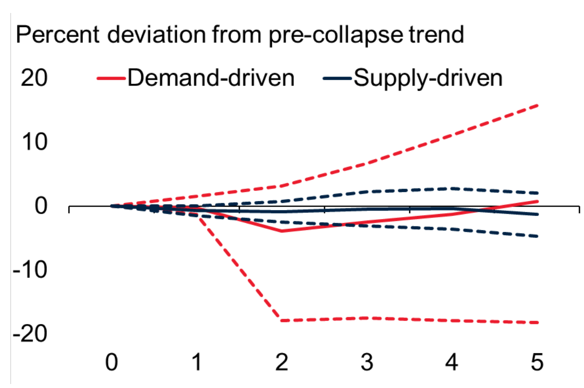
D. EMDEs (unweighted average)



E. EMDE energy exporters (unweighted average)



E. Other EMDEs (unweighted average)



Note: Figures show deviation in real GDP from output trend during the ten years before the collapse. Dotted lines are maximum and minimum.
A.B.C. GDP-weighted averages (at 2010 market exchange rates and prices).
D.E.F. Unweighted averages, for closer consistency with the regression analysis.

Table 1. Evolution of oil prices in oil price collapses

	Demand-driven						Supply-driven		
	Average	2020	2009	2001	1998	1991	Average	2014	1986
Amplitude (percent change peak to trough)	-56.0	-66.8	-68.9	-42.3	-48.1	-53.9	-69.4	-72.5	-66.4
Duration (months from peak to trough)	14.6	4	5	15	14	35	13.5	19	8
Speed (percent change per month from peak to trough)	-7.7	-16.7	-13.8	-2.8	-3.4	-1.5	-6.1	-3.8	-8.3
Half-way recovery speed (percent change per month from trough half-way to pre-collapse peak)	15.2	33.4	4.9	9.3	13.1	...	7.0	5.2	8.7
Pre-plunge price runup (percent change from preceding trough to peak)	9.5	1.5	8.1	4.2	2.0	31.5	1.2	0.7	1.7

Sources: World Bank.

Note: Pre-collapse peaks are defined as November 1985 (1986 episode), October 1990 (1991 episode), October 1997 (1998 episode), September 2000 (2001 episode), July 2008 (2009 episode), June 2014 (2014 episode), and December 2019 (2020 episodes). July 2020 oil price ($66.5 per barrel), the last available datapoint, rounded to half-way price recovery ($66.6 per barrel).

Table 2. Evolution of oil demand, supply and inventories in oil price collapses

	Demand-driven						Supply-driven		
	Average	2020	2009	2001	1998	1991	Average	2014	1986
Demand during price collapse 1/									
Amplitude (percent change during price collapse)	-8.0	-22.0	-3.5	-1.5	-5.0	..	..	-0.6	..
Duration (months of demand increase during price collapse)	5.5	4	4	7	7	..	..	11	..
Speed (percent change per month during price collapse)	-1.8	-5.5	-0.9	-0.2	-0.7	..	..	-0.1	..
Half-way recovery speed (percent change per month during price recovery)	-1.3	-6.1	0.2	0.2	0.4	..		`0.3	
Supply during price collapse 2/									
Amplitude (percent change during price collapse)	1.3	2.0	-1.1	1.3	2.1	2.3	4.0	4.2	3.7
Duration (months of supply decline during price collapse)	5	4	1	2	4	15	12.5	17	8
Speed (percent change per month during price collapse)	0.2	0.5	-1.1	0.7	0.5	0.2	0.4	0.2	0.5
Half-way recovery speed (percent change per month during price recovery	-0.4	..	-0.8	-0.2	-0.1	..	0.0	0.4	-0.5
Inventory buildup 3/									
Amplitude (percent change during price collapse)	3.9	11.4	1.6	3.0	4.7	-1.0	..	14.9	..
Duration (months of supply decline during price collapse)	13	4	5	14	9	33	..	19	..
Speed (percent change per month during price collapse)	0.8	2.9	0.3	0.2	0.5	0.0	..	0.8	..
Half-way recovery speed (percent change per month during price recovery)	0.2	..	0.0	0.4	0.1	..	..	1.2	..

Sources: Energy Information Administration, World Bank.

Notes: Pre-collapse peaks are defined as November 1985 (1986 episode), October 1990 (1991 episode), October 1997 (1998 episode), September 2000 (2001 episode), July 2008 (2009 episode), June 2014 (2014 episode), and December 2019 (2020 episodes). Data for monthly petroleum consumption only available from January 1997. Data for monthly OECD petroleum inventories only available from January 2003; hence, spliced with monthly data from U.S. inventories for January 1990-December 2002. Data for monthly total petroleum and other liquids production only available for January 1990-March 2020; hence, spliced with data from OPEC s Monthly Report for April and May 2020 and spliced with crude oil production for 1973-1989. Price collapse is period from pre-collapse peak to subsequent trough in prices. Price recovery is period from this trough in prices to half-way recovery.

1/ Amplitude, duration and speed are based on largest demand decline from the beginning of the price collapse to the trough of the price collapse. Recovery speed is based on largest increase in demand during recovery period.

2/ Amplitude, duration and speed are based on largest supply increase from the beginning of the price collapse to the trough of the price collapse. Recovery speed is based on largest increase in supply during recovery period.

3/ Amplitude, duration and speed are based on largest inventory increase from the beginning of the price collapse to the trough of the price collapse. Recovery speed is based on largest inventory drawdown during recovery period.

Table 3. Cumulative response of EMDE output to oil price collapses

	Baseline	With interaction terms		
	Oil price collapse	Oil price collapse	Oil price collapse * exporter status	Prob (oil price collapse + oil price collapse * exporter status = 0)
1	-0.158	-0.149	-0.0450	0.721
	[0.200]	[0.211]	[0.585]	..
2	-1.546***	-1.394***	-0.737	0.070
	[0.372]	[0.378]	[1.250]	..
3	-2.300***	-2.120***	-0.873	0.008
	[0.469]	[0.524]	[1.236]	..
4	-2.601***	-2.257***	-1.668	0.001
	[0.521]	[0.592]	[1.324]	..
5	-2.710***	-2.188***	-2.558*	0.000
	[0.585]	[0.675]	[1.411]	..

Note: Table shows regression coefficients from a local projection model of real GDP growth at forecast horizons 1-5 for 153 EMDEs for 1980-2019. The first results column (labelled "Baseline") shows the regression coefficient on a dummy for oil price collapses as specified in equation (1). The last three columns show the coefficient estimates on a dummy for oil price collapses, an interaction term between this dummy and a dummy for exporter status (labelled "Oil price collapse * exporter status"), and the probability that the output response in energy exporters to an oil price collapse is zero ("labelled Prob(oil price collapse + oil price collapse * exporter status=0)"). *** $p<0.01$, ** $p<0.05$, * $p<0.1$ and standard errors in square brackets.

Table 4. Response of EMDE output to demand- and supply-driven oil price collapses, by exporter status

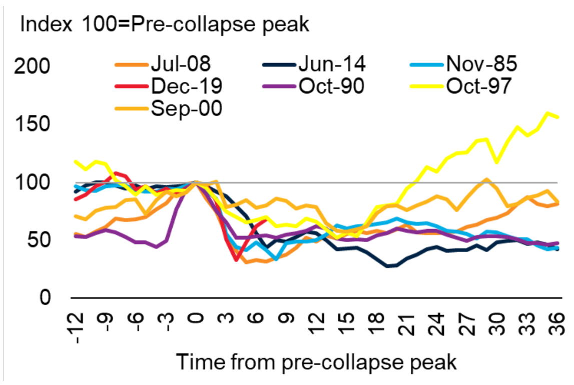
Horizon	Demand-driven collapse	Demand-driven collapse * exporter status	Supply-driven collapse	Supply-driven collapse * exporter status	Prob (demand-driven collapse = supply-driven collapse)	Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)	Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)
1	-0.0941	0.493	-0.250	-1.051	0.741	0.588	0.011
	[0.261]	[0.781]	[0.381]	[0.639]	..	..	..
2	-1.865***	0.189	-0.518	-2.454**	0.029	0.304	0.001
	[0.462]	[1.715]	[0.506]	[1.010]	..	..	..
3	-3.011***	1.104	-0.469	-4.532***	0.002	0.197	0.000
	[0.690]	[1.635]	[0.573]	[1.204]	..	..	..
4	-3.416***	1.045	-0.516	-7.321***	0.005	0.08	0.000
	[0.785]	[1.553]	[0.749]	[1.696]	..	..	..
5	-3.094***	0.0593	-0.420	-9.659***	0.025	0.02	0.000
	[0.747]	[1.502]	[1.080]	[2.161]	..	..	..

Note: Table shows regression coefficients from a local projection model of real GDP growth at forecast horizons 1-5 for 153 EMDEs for 1980-2019. The model includes separate dummies for demand-driven and supply-driven oil price collapses and interaction terms for each of these dummies with a dummy for energy exporter status. The regression includes country fixed effects but no constant. The last three columns show the probability of tests for demand-driven and supply-driven oil price collapses having the same effect (labelled "Prob(demand-driven collapse=supply-driven collapse")), for demand-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)"), and for supply-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)"). *** $p<0.01$, ** $p<0.05$, * $p<0.1$ and standard errors in square brackets.

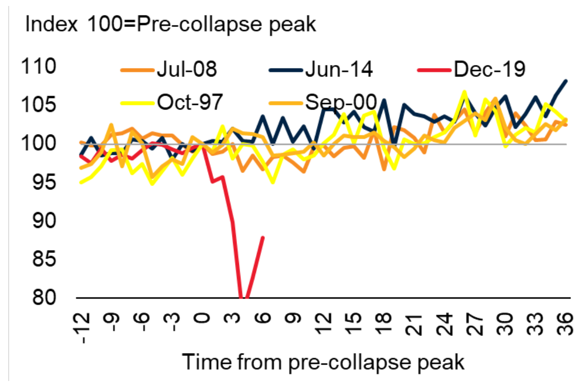
Supplemental Annex

Supplemental Annex Figure 1. Evolution of oil prices, oil demand, oil production, and oil inventories around oil price collapses.

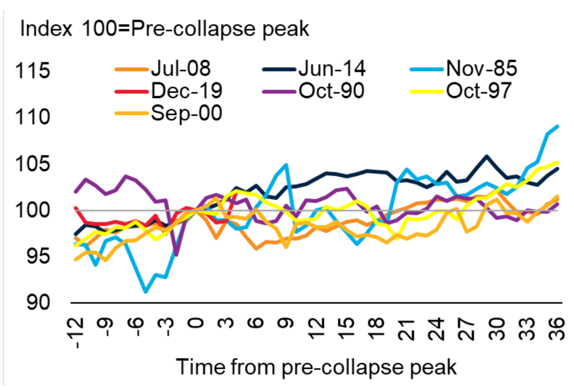
A. Oil prices



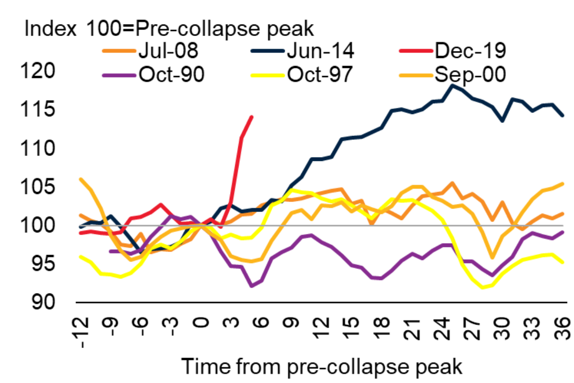
B. Oil demand



C. Oil supply



D. Oil inventories



Sources: Energy Information Administration; OPEC; World Bank.
Notes: Pre-collapse peaks are defined as November 1985 (1986 episode), October 1990 (1991 episode), October 1997 (1998 episode), September 2000 (2001 episode), July 2008 (2009 episode), June 2014 (2014 episode), and December 2019 (2020 episodes). Data for monthly petroleum consumption ("oil demand") only available from January 1997. Data for monthly OECD petroleum inventories ("oil inventories") only available from January 2003; hence, spliced with monthly data from U.S. inventories for January 1990-December 2002. Data for monthly total petroleum and other liquids production ("oil supply") only available for January 1990-March 2020; hence, spliced with data from OPEC s Monthly Report for April and May 2020 and spliced with crude oil production for 1973-1989. Oil prices are the unweighted average of Brent, West Texas Intermediate and Dubai oil prices, as reported in the World Bank's *Pink Sheet*. Grey horizontal line indicates 100. All series are scaled to 100 for the month in which oil prices peaked before the collapses (within a twelve-month window).

Supplemental Annex Table 1. Cumulative response of output to demand- and supply-driven oil price collapses, by exporter status, excluding 1990-91 episode

Horizon	Demand-driven collapse	Demand-driven collapse * exporter status	Supply-driven collapse	Supply-driven collapse * exporter status	Prob (demand-driven collapse = supply-driven collapse)	Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)	Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)
1	0.149	1.739	-1.251	-0.643	0.298	0.115	0.024
	[0.639]	[1.272]	[1.216]	[1.470]	..	..	..
2	-2.109*	2.366	-1.129	-4.374**	0.569	0.89	0.000
	[1.203]	[2.166]	[1.430]	[2.035]	..	..	..
3	-1.605	3.869	-0.166	-8.265**	0.511	0.479	0.010
	[1.817]	[3.615]	[1.625]	[3.451]	..	..	..
4	-0.0549	-0.809	0.169	-13.59***	0.925	0.83	0.006
	[2.410]	[4.654]	[1.956]	[5.033]	..	..	..
5	2.412	-2.356	2.787	-20.82***	0.883	0.993	0.009
	[3.410]	[7.347]	[2.658]	[7.030]	..	..	..

Note: Table shows regression coefficients from a local projection model of real GDP growth at forecast horizons 1-5 for 153 EMDEs for 1980-2019. This differs from the results in Table 4 by dropping the oil price collapse of 1990-91. The regression includes country fixed effects but no constant. The last three columns show the probability of tests for demand-driven and supply-driven oil price collapses having the same effect (labelled "Prob(demand-driven collapse=supply-driven collapse")), for demand-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)"), and for supply-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)"). *** p<0.01, ** p<0.05, * p<0.1 and standard errors in square brackets.

Supplemental Annex Table 2. Cumulative response of output to demand- and supply-driven oil price collapses, by exporter status, anchoring events in year of price trough

Horizon	Demand-driven collapse	Demand-driven collapse * exporter status	Supply-driven collapse	Supply-driven collapse * exporter status	Prob (demand-driven collapse = supply-driven collapse)	Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)	Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)
1	-1.702***	-0.200	-0.220	-1.079	0.000	0.020	0.090
	[0.306]	[0.861]	[0.284]	[0.815]	..	..	..
2	-2.888***	0.611	-0.259	-3.003**	0.000	0.002	0.004
	[0.542]	[0.888]	[0.423]	[1.182]	..	..	..
3	-3.168***	0.555	-0.451	-5.152***	0.001	0.029	0.000
	[0.649]	[1.333]	[0.563]	[1.611]	..	..	..
4	-3.482***	1.020	-0.871	-6.223***	0.012	0.041	0.000
	[0.702]	[1.356]	[0.771]	[1.907]	..	..	..
5	-3.402***	-0.396	-2.620**	-9.851***	0.486	0.001	0.000
	[0.726]	[1.359]	[1.136]	[2.842]	..	..	..

Note: Table shows regression coefficients from a local projection model of real GDP growth at forecast horizons 1-5 for 153 EMDEs for 1980-2019. This differs from the results in Table 4 by defining event years to be the years in which prices bottomed out (instead of the year in which the price collapse began). The regression includes country fixed effects but no constant. The last three columns show the probability of tests for demand-driven and supply-driven oil price collapses having the same effect (labelled "Prob(demand-driven collapse=supply-driven collapse")), for demand-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)"), and for supply-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)"). *** p<0.01, ** p<0.05, * p<0.1 and standard errors in square brackets.

Supplemental Annex Table 3. Cumulative response of output to demand- and supply-driven oil price collapses, by exporter status, anchoring events in year of price trough

Horizon	Demand-driven collapse	Demand-driven collapse * exporter status	Supply-driven collapse	Supply-driven collapse * exporter status	Prob (demand-driven collapse = supply-driven collapse)	Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)	Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)
1	-0.523	0.673	-1.365	-0.556	0.529	0.903	0.017
	[0.566]	[1.290]	[1.235]	[1.476]	..	..	..
2	-3.412***	1.559	-1.401	-4.287**	0.253	0.305	0.000
	[1.094]	[1.940]	[1.439]	[1.931]	..	..	..
3	-4.440**	2.497	-0.863	-8.519***	0.118	0.452	0.000
	[1.656]	[2.783]	[1.619]	[2.787]	..	..	..
4	-3.821*	-4.172	-1.031	-13.44***	0.261	0.109	0.000
	[2.012]	[5.120]	[1.894]	[4.039]	..	..	..
5	-3.745	-4.713	0.677	-21.05***	0.114	0.162	0.000
	[2.475]	[6.433]	[2.483]	[5.050]	..	..	..

Note: Table shows regression coefficients from a local projection model of real GDP growth at forecast horizons 1-5 for 153 EMDEs for 1980-2019. This differs from the results in Table 4 by using two lags (instead of one). The regression includes country fixed effects but no constant. The last three columns show the probability of tests for demand-driven and supply-driven oil price collapses having the same effect (labelled "Prob(demand-driven collapse=supply-driven collapse")), for demand-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (demand-driven collapses + demand-driven collapse * exporter status = 0)"), and for supply-driven collapses having the same effects on energy exporters as on other EMDEs (labelled "Prob (supply-driven collapses + supply-driven collapse * exporter status = 0)"). *** $p<0.01$, ** $p<0.05$, * $p<0.1$ and standard errors in square brackets.

Supplemental Annex Table 4. Cumulative response of output to demand- and supply-driven oil price collapses, by exporter status

	EMDEs			EMDE energy exporters			Other EMDEs		
Horizon	Oil demand shock	Oil supply shock	Prob (demand-driven collapse = supply-driven collapse)	Oil demand shock	Oil supply shock	Prob (demand-driven collapse = supply-driven collapse)	Oil demand shock	Oil supply shock	Prob (demand-driven collapse = supply-driven collapse)
1	0.00803	-0.466	0.254	0.564	-1.173**	0.0432	-0.108	-0.259	0.751
	[0.257]	[0.321]	..	[0.667]	[0.512]	..	[0.265]	[0.383]	..
2	-1.825***	-1.023**	0.182	-1.155	-2.579***	0.388	-1.923***	-0.559	0.0288
	[0.482]	[0.442]	..	[1.383]	[0.925]	..	[0.474]	[0.512]	..
3	-2.782***	-1.403***	0.0668	-1.066	-4.311***	0.0479	-3.088***	-0.527	0.00204
	[0.623]	[0.522]	..	[1.195]	[1.221]	..	[0.705]	[0.579]	..
4	-3.198***	-2.023***	0.207	-1.171	-6.547***	0.00477	-3.512***	-0.608	0.00557
	[0.686]	[0.690]	..	[1.220]	[1.806]	..	[0.803]	[0.748]	..
5	-3.070***	-2.396**	0.522	-0.780	-7.532**	0.00126	-3.188***	-0.505	0.0256
	[0.651]	[0.975]	..	[1.954]	[3.054]	..	[0.747]	[1.070]	..

Note: Table shows regression coefficients from a local projection model of real GDP growth at forecast horizons 1-5 for 153 EMDEs for 1980-2019. This differs from the results in Table 4 by using subsamples of demand-driven and supply-driven oil price collapses and energy exporting and other EMDEs. The regression includes country fixed effects but no constant. The three columns labelled "Prob(demand-driven collapse = supply-driven collapse))" show the probability that the coefficient estimates on a dummy for demand-driven oil price collapses differs from the coefficient estimates for a dummy for supply-driven oil price collapses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ and standard errors in square brackets.