MONETARY AND CAPITAL MARKETS

Special Series on COVID-19

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Assessing Stress from Oil Price Shocks[1]

This note aims to help country authorities in oil-exporting economies by providing guidance on how to assess the impact of the recent fall in oil prices on bank soundness. The note discusses macroeconomic scenarios and transmission channels impacting banks.

I. FIRST STEP: MACROECONOMIC SCENARIOS

The recent fall in in oil prices is bound to impact negatively most financial systems, especially those of oil-exporting countries. Key direct effects include deteriorating exposures to oil-related sectors and a tightening of domestic liquidity conditions. Indirect effects include the effect on the quality of exposures caused by a deterioration of balance sheets of the government, household, and nonfinancial corporate sectors.

A key step in assessing the impact of oil prices on banks is the articulation of a macroeconomic scenario, inclusive of an adjustment path. The magnitude and nature of the adjustment needed after an oil price shock depends on the policy framework, existing buffers, and the expected duration of the shock. The responses to an oil price shock can range from a temporary loss in international reserves to a nominal devaluation/depreciation, and, a countercyclical fiscal response. Country authorities will need to consider the country's institutional features (including fiscal rules, where relevant) and its macro-financial buffers when deciding whether a policy response must be part of a realistic macroeconomic scenario.

Institutional features and buffers that warrant attention include:

- *Fiscal buffers, including via sovereign wealth funds (SWFs)*. These can be used to counteract the effects of temporary shocks and provide banking system backstops. They can also influence the size of shocks to sovereign spreads that can be transmitted to banks' funding costs.

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- *Exchange rate regime*. For fixed exchange rate regimes, country authorities need to determine whether the parities can be sustained or whether exchange rate adjustments are needed or desirable.
- *Financial dollarization*. Currency mismatches in banks, corporates, and households must be examined to assess potential balance-sheet effects of exchange rate adjustments, where relevant.
- *International reserves*. Countries need to assess whether the central bank has the capacity to provide emergency liquidity in foreign exchange (FX) in dollarized systems.
- *Interest rates.* Domestic interest rates are key drivers of bank losses through impacts on interest margins, bank clients' interest burdens, and the repricing of securities portfolios. While policy rates may decline, effective rates paid by customers and the government could increase due to country risk, in particular if there is a rating downgrade.

The depth and duration of the fall in GDP are likely to be the key drivers of the impact of a decline in oil prices. Models of the transmission of macroeconomic shocks to banks typically feature dynamic nonlinear effects (see below). As a result, short- and long-lived shocks of similar cumulative intensity could have substantially different impacts on bank soundness. Similarly, nonlinearities imply that an increase in the size of macroeconomic shocks can result in a more than proportional increase in bank losses.

In light of the uncertainty around the future path of oil prices and the external environment more generally, country authorities may need to consider more than one scenario based on the following:

- ***A short-lived oil price shock coupled with fiscal policy accommodation, if feasible***.[2] A government spending increase, financed through an asset rundown or debt increase, can be used to minimize the impact of lower oil prices on GDP; tax relief measures can also be used. When sizable buffers are available, the sovereign bond yield impact will be smaller than without such buffers. Where there is no fiscal space, spending cuts may need to be assumed, and this would exacerbate the decline in GDP.
- ***A prolonged oil price shock coupled with fiscal adjustment***. In this case, government spending must be reduced and/or revenue mobilization efforts strengthened over the medium term to preserve the sustainability of public finances.[3] This would worsen the decline in GDP.
- ***A prolonged oil price shock with no fiscal adjustment***. While the negative impact on GDP could be weaker than in the case of concomitant spending cuts, the financial impact would likely be worse, as sovereign bond yields would rise sharply as markets anticipate the eventual depletion of buffers; capital outflows could be more intense; foreign credit lines to banks could be interrupted, triggering liquidity problems; and an eventual devaluation could lead to bank losses (directly if banks' net FX positions are negative, or indirectly through credit losses from defaults of unhedged borrowers).

Given the current international environment, consideration should also be given to additional shocks and their interaction with declining oil prices:

- ***A larger or more persistent than anticipated fall in global GDP growth.***

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[2] In the current juncture, due to the confluence of adverse supply and demand conditions, oil sector analysts are not expecting a significant and sustained rebound in prices anytime soon (Butler, March 16, 2020).

[3] These efforts may include reduced subsidies and increased fuel taxes, where possible, to re-gain some fiscal space and work towards climate mitigation.

- ***A collapse in asset prices.*** Domestic asset price and oil price cycles are generally highly synchronized—as wealth effects fuel or weaken demand for real estate and financial assets. However, alternative scenarios could explore bank vulnerabilities to oil and asset price shocks that materialize with different degrees of synchronicity.

- ***Global decarbonization.*** Policy action on climate change is likely to temporarily lose momentum during crisis times, but the fundamental trend towards decarbonization is unlikely to change, implying a long-term progressive decline of crude oil demand (Annex). Similarly, technological breakthroughs that substantially improve the appeal of oil substitutes for consumers could limit the room for a rebound of oil prices from low levels.

Scenarios comprise also paths for other macroeconomic variables. The paths of relevant macroeconomic variables should be mutually consistent. In addition to real GDP, variables needed to characterize a scenario include unemployment, inflation, short-term interest rates, long-term interest rates (which can be derived from the time path of short-term rates and the path of sovereign credit risk premia), and the exchange rate.

It is important to differentiate oil and non-oil GDP, particularly in countries where the latter is large. While it may be small in some oil exporters, the non-oil sector is large in others (e.g. UK, US, Norway, Mexico). Non-oil GDP includes non-tradable goods and services, which will suffer the most, and non-oil export and import-competing sectors, which could benefit under the stress scenario. Allowing for a different impact of oil price shocks across economic sectors is important to identify those in which NPL ratios could increase sharply. Based on the sectoral composition of credit, one could identify banks that are most exposed.

FSAPs have been conducted in oil-exporting countries prior to sharp oil price declines:

- In FSAPs conducted during 2013–14—immediately before the 2014 oil crash—temporary (Brent) oil price shocks embedded in macroeconomic scenarios range from a US$30 decline (e.g., from US$100 to US$70 in an adverse scenario) to a US$60 decline (e.g., from US$100 to US$40 in an extremely adverse scenario). The scenarios also incorporate country-specific non-oil shocks, which makes stress test results not strictly comparable across countries. The list of FSAPs includes: Chad (2011), Nigeria (2013), Algeria (2014), CEMAC (2016), and Kazakhstan (2014).

- FSAPs conducted since 2016 in oil-producing countries consider scenarios with starting Brent oil prices at US$50–60 and assume oil price shocks ranging from 30 percent to 65 percent (for example, Russia, 2016; Saudi Arabia, 2017; and Kuwait, 2018).

- These FSAPs provide examples of fully-fledged macroeconomic scenarios designed on the basis of projected path for oil prices.

II. NEXT STEPS: FROM SCENARIOS TO BANK SOUNDNESS

Figure 1 shows mechanisms through which an oil price shock can be transmitted to banks. The policy response will help determine the impact on GDP, short-term interest rates and sovereign bond yields, and the exchange rate.

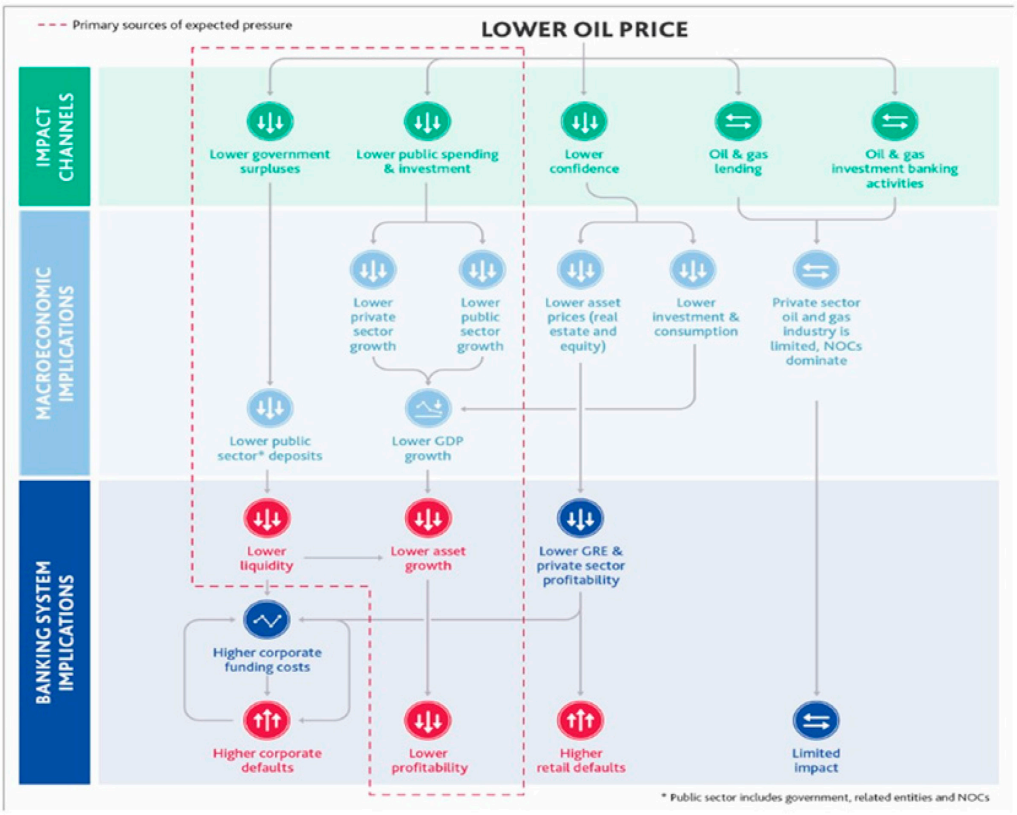
- ***Lower GDP growth will impact bank solvency through increased NPL ratios and provisioning requirements***. These credit losses will materialize due to higher incidence of borrowers' defaults, including from households and corporate sectors closely related to the oil sector and firms operating in the non-tradable sector. The incidence of defaults could be exacerbated by a sharp decline in real estate and other asset prices. Typically, these effects are estimated using *dynamic* and *nonlinear* credit

risk satellite models—a complex, data driven, and time intensive process. For banks tighter financial conditions (e.g. from higher spreads, particularly in case of a rating downgrade)—could lead to reduced net interest income (deposit rates are re-set faster than lending rates, as deposits tend to have shorter maturities than loans). If granular supervisory data are available, this effect can be quantified through interest gap analysis applied to individual banks. Alternatively, a less preferred option consists in estimating panel data models of net interest income using historical data for individual banks.

- ***The increase in sovereign and corporate bond yields will trigger market losses in banks' trading portfolios***. This effect is typically approximated using valuation formulas based on modified duration or calculated through full (exact) repricing when sufficient information on individual bond positions for each bank is available.
- ***A nominal depreciation will trigger direct losses*** in banks with negative net FX positions.[4]
- ***A nominal depreciation will also trigger indirect losses*** through higher incidence of defaults in FX loan portfolios comprising un-hedged borrowers with revenues in domestic currency. Thus, taking into account the degree of dollarization in the economy is important for the assessment of potential credit losses—estimated using credit risk satellite models.
- ***The combined impact*** of the shocks will also lead to revisions of banks' future earnings growth.

[4] When assessing these, attention must be paid to available hedges and the likelihood that these will be renewed.

Figure 1. Transmission Channels-Impact of Lower Oil Prices on Banks



Source: Moody's Investors Service, Financial Institutions, Sector Comment, March 4, 2015.

Note: NOC stands for National Oil Companies.

Important issues to take into account when analyzing the transmission include:

- ***Bank-government links.*** These reflect connections on both the asset and liability sides of the banks. *On the asset side*, banks lend directly to the government or affiliated entities. They are also exposed to developments in the government sector indirectly (e.g., mortgage lending to government employees or to employees of government contractors). *On the liability side*, the government or affiliated entities may be significant shareholders and depositors in the banking system. This poses funding risks to banks. For instance, in adverse scenarios, governments (or SWFs) may need to liquidate foreign assets or withdraw deposits to finance widening fiscal deficits. This may be mitigated only partially by the government's backstopping of banks. In addition, sometimes the government guarantees certain bank assets (such as mortgages), which raises the possibility that if government finances come under stress, the guarantees may not be honored.

- **Domestic credit risk diversification is difficult**. Categories of bank credit portfolios can be classified in terms of their exposure to the oil and government sectors. Direct credit provision to the government, their affiliated entities, or national oil companies. The oil shock will reduce credit demand even if the solvency of borrowers remains strong. Slower loan growth will impact bank profitability, and bank stock prices will decline. Also, to the extent that market interest rates and sovereign bond yields rise, banks will suffer market losses on their sovereign bond holdings. Credit to government contractors, companies with links to national oil companies, and loans to government employees. Lower government spending and oil sector activity will weaken the solvency of these borrowers, exposing banks to heightened credit risk. NPL ratios would rise and banks would incur credit losses from higher provisioning requirements. Reduced government spending could also increase delinquency in mortgage loans. Credit to

households, the real estate sector, and non-oil companies. The connection between oil price shocks and credit losses in these loan portfolios will be less tight than in the abovementioned cases. The increase in NPL ratios will be more marked the larger is the decline in asset prices and non-oil economic activity. Increases in sovereign bond yields are likely to be passed onto non-oil corporate bond yields, which will further exacerbate bond portfolio losses.

The impact of an oil price shock on banks also depends on risk management practices. An enquiry of prudential requirements, risk weighting of assets by banks, and supervisory enforcement will help understand whether or not the risk was properly managed ex-ante. Banks could have limited their vulnerability to oil price shocks through different means:

- ***International diversification of investments and lending operations***. Many banks in oil-exporting countries have expanded internationally and provide loans abroad. Banks also tend to hold sizable portfolios of investments in foreign securities. The extent to which these strategies will help limit losses in the current environment, however, depends on the overall impact of the Covid19 containment measures on the global economy.

- ***In the short-term, banks could hedge oil price risk through the use of derivatives contracted in international markets***. Given the obstacles to achieve domestic risk diversification, oil derivatives are often used to hedge risks that are highly correlated with oil price shocks. It is thus important to assess the size and composition of banks' derivatives portfolios, as assessments based on balance sheet information alone could be misleading.

- ***Conservative practices in banks' capitalization, risk weighting of assets, large exposures, and risk concentration would also help mitigate shocks***. Information on these issues can be obtained from previous FSAP documents (Financial System Stability Assessments or publicly available reports on compliance with Basel Core Principles). Basel Committee country reports on Regulatory Consistency Assessment Programs and Basel Committee standards on Supervisory Framework for Measuring and Controlling Large Exposures (BCBS, 2014) can also be informative. However, direct application of Basel II/III capital adequacy formulas may be problematic in oil-exporting countries. These calculations assume highly diversified credit portfolios and are calibrated for advanced economies. In oil-exporting countries, appropriately measured required capitalization may exceed those calculated using the Basel II/III formulas.

Credit losses are likely to be a key driver of banks' reduced profits and capital. These losses arise not only from the oil companies, but from households and companies in the oil sector, and in the non-oil sector, which, as mentioned above can be large in some countries. Losses will depend on the characteristics of loans (floating or fixed interest; currency denomination) and borrowers, and the type of collateral used by borrowers. In particular:

- ***Default probabilities may be magnified for loans denominated in FX or with floating interest rates***. Capturing transmission channels by estimating a (satellite) credit risk model is essential for a complete analysis of bank vulnerabilities. The dependent variable measures a borrowers' creditworthiness (such as NPLs or default probabilities). Explanatory variables typically include bank-specific controls as well as the variables projected under the macroeconomic scenarios: GDP (or non-oil GDP), interest rates, the exchange rate, and possibly the price of oil—depending on the type of borrower. More granular analysis could be undertaken in countries that collect information on individual loans and associated debt service-to-income ratios. In these cases, the stress tester may be able to estimate trigger points and assess in a more direct way the determinants of credit losses for corporate and household loans.

- ***Credit risk may also affect Loss Given Default (LGD) and the value of bank positions***. This is the case when real estate is used as collateral (e.g., mortgage loans or covered bonds issued with real estate as underlying assets). In such cases, adjustments to LGDs or to the value of bond holdings through haircuts are warranted. Adjustments would depend on the projected decline in real estate prices.

Valuation losses in bond portfolios are another potential driver of banks' losses. Whenever possible, country authorities will need to assess the impact of oil shocks on sovereign bond yields, and in turn, translate them into valuation losses for banks. The precise impact will depend on whether the sovereign bonds are held to maturity, available for sale, or held for trading—with maximum impact materializing only when all bonds are placed in the latter account.

In adverse scenarios, the resulting capital adequacy ratios (CARs) will be determined by the losses and the regulatory regime. Country authorities will need to estimate the losses, which would affect capital (the numerator of the CAR), as well as higher capital requirements due to higher risk weighted assets (the denominator of the CAR). As explained above, losses in capital would be triggered by higher default risk of corporate or sovereign clients, lower collateral values, and direct losses due to market risk. However, even non-defaulted loans or bonds could conceivably become riskier under a scenario of lower oil prices. Whether this would translate into higher risk-weighted assets would depend on whether the banks operate under Basel I, Basel II/STA or Basel II/IRB.

Financial institutions' health should be assessed on a standalone basis even when central bank reserves and fiscal buffers can be used to safeguard financial stability. Governments in oil-exporting countries have used these buffers to solve or contain financial sector problems. However, widespread use of backstops is a symptom of system malfunctioning. Thus, tests aimed at assessing solvency or liquidity generally assume that backstops are not activated.

When reliable market data are available, solvency stress tests can be complemented by an analysis of inter-sector linkages in the economy. This can be done using flow of funds data showing gross asset and liability positions across economic sectors.

III. LIQUIDITY EFFECTS

Liquidity effects of oil price declines are also important. Funding liquidity pressures in banking institutions often arise as a result of a deterioration in macroeconomic conditions that weakens bank solvency (capitalization and NPL ratios) and undermine investors' and depositors' confidence. However, in the current Covid-19 crisis, some governments have adopted debt moratoria and loan service forbearance measures that can directly impact the liquidity positions of banks. These measures are aimed at mitigating financial stress at the corporate and household levels, but they may cause sharp reductions in banks' cash inflows and strain their overall liquidity positions.

In normal circumstances, following a sharp decline in terms of trade, banks may experience liquidity problems as international reserve losses tighten domestic liquidity. This can be followed by bank customers making use of credit lines, or depositors and providers of wholesale bank funding restricting their lending and moving toward assets perceived to be safer. The impact of these developments, together with those of the government interventions mentioned above, must be monitored carefully and at high frequencies. Projections of banks liquidity conditions should be considered where the data are available, and the potential impact of liquidity stress on bank solvency should be factored in. In addition, liquidity stress tests can be used to quantify the potential

impact on banks of further deteriorations in market conditions. The exercise could serve to take remedial action and prevent a downward spiral that could lead to a systemic liquidity crisis.

Where relevant, liquidity in foreign currency may also tighten if banks experience difficulty accessing external sources of funding. It is thus important to monitor also potential foreign currency liquidity needs (including through liquidity stress tests in foreign currency) and comparing these with the central bank's ability to provide support through the deployment of its foreign reserves (Adrian, Morsink, and Schumacher 2020).

ANNEX. Oil Price Shocks and the Energy Transition

	Impact of oil shocks (↗ for increase and ↘ for reduction)		
Shock	**Short term (1-2 years)**	**Medium term (3-5 years)**	**Long term (>5 years)**
Low oil price	↗ oil demand ↘ electric vehicle (EV) demand ↘ energy efficiency ↗ room to slash fossil fuel energy subsidies and increase carbon prices ↘ fiscal space for higher-cost oil producers	↘ investments in oil exploration ↘ investments in alternative energy sources (e.g. renewables and battery storage) ↘ investors' interest in oil companies ↘ investors' interest in high-cost oil-producing countries	↘ oil supply ↘ alternative energy supply ↗ oil price
High oil price	↘ oil demand ↗ electric vehicle (EV) demand ↗ energy efficiency ↘ room to slash fossil fuel energy subsidies and increase carbon prices ↗ fiscal space for higher-cost oil producers	↗ investments in oil exploration ↗ investments in alternative energy sources (e.g. renewables and battery storage) ↗ investors' interest in oil companies ↗ investors' interest in high-cost oil-producing countries	↗ oil supply ↗ alternative energy supply ↘ oil price

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