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Qatar: Selected Issues

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QATAR

SELECTED ISSUES

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QATAR

SELECTED ISSUES

January 8, 2024

Approved By
Middle East and Central Asia Department

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CONTENTS

FINANCIAL CONDITIONS AND THEIR GROWTH IMPLICATIONS FOR QATAR[1]

This paper develops a Financial Conditions Index (FCI) for Qatar and uses the Growth-at-Risk (GaR) framework to examine the impact of financial conditions on Qatar's non-hydrocarbon growth. The analysis shows that the FCI is an important leading indicator of Qatar's non-hydrocarbon growth, highlighting its predictive potential for future economic performance. The GaR framework suggests that overall, the current downside risks to Qatar's baseline non-hydrocarbon growth projections are relatively mild.

A. Introduction

1. Financial conditions play a significant role in shaping business cycle fluctuations. They reflect both the feedback of current and past economic conditions and markets' expectations about the economic outlook. Thus, there has been a concerted effort toward the continuous monitoring of financial conditions, leading to the development of financial conditions indices (FCIs). FCIs are constructed from a broader combination of domestic and external financial conditions. They serve as tools that facilitate a deeper understanding of macro-financial linkages, as well as enable historical assessments by comparing the current state of financial conditions against their past cycles. Beyond their contribution to the formulation of monetary policy, FCIs can provide important signals on the current state of financial conditions and their potential impact on economic activity.

2. FCIs can be considered as extensions of the monetary conditions indices (MCIs). Whereas the traditional MCIs are limited to the monetary policy stance and how it propagates through the economy, FCIs introduce the role of financial variables such as asset prices, long-term interest rates and liquidity indicators in determining the financial conditions at a given point in time. During periods of financial stress, FCIs can be a better indicator of financial conditions compared to traditional MCIs, thanks to their capacity to capture a wider range of financial dynamics. For instance, during the global financial crisis (GFC) and the Covid-19 shock, while monetary conditions remained loose due to relatively low policy interest rates, global financial conditions remained tight due to balance sheet constraints and increased uncertainty (see for example Angelopoulou and others, 2014 and Çolak and Öztekin, 2021).

3. Developing an FCI has become even more important as Qatar aims to further develop the financial sector through the Third Financial Sector Strategy (FSS3). In Qatar, the financial sector plays an important role in shaping economic activity, and therefore serves as a key pillar in fostering the country's sustainable economic development. The FSS3 aims to enhance innovation and diversification in the financial sector, and to support the country's goal to become a global

[1] Prepared by Dorothy Nampewo. The author would like to thank the participants of the 2024 Staff Visit Workshop at the Ministry of Finance for their very helpful suggestions and comments.

financial services center. An FCI would be important in assessing the current state of financial health, gauging the impact of initiatives aimed at fostering financial market deepening, and evaluating the nexus between financial indicators and the distribution of future growth.

4. We develop an FCI for Qatar, employing two widely used methods. The principal components approach (PCA) and the weighted sum vector autoregression (VAR) approach (WSA-VAR). The PCA method is a statistical approach designed to extract a common factor from a broad array of financial variables. The WSA-VAR method quantifies FCIs based on their impact on Qatar's non-hydrocarbon GDP growth. We further explore the nexus between financial conditions and Qatar's future non-hydrocarbon economic activity through the growth-at-risk (GaR) framework. The GaR framework enables the assessment of how different aspects of financial conditions may influence short and medium-term growth prospects.

5. This note is organized as follows. The next section provides an overview of the methodology for constructing the FCIs for Qatar. The subsequent section provides an overview of the FCIs for Qatar. The section after discusses the impact of financial conditions on non-hydrocarbon growth using the Growth-at-Risk (GaR) framework. The last section concludes.

B. Constructing a Financial Conditions Index for Qatar: Methodology

6. We employed the principal components approach (PCA) and the weighted sum VAR (WSA-VAR) approach to construct an FCI for Qatar. The PCA models the variance structure of the financial variables by extracting a common factor from a set of financial indicators that captures the optimal linear combination of the observed financial variables in the following representation:

$$\bar{X}_t - \mu = \beta F_t + U_t \qquad (1)$$

Where, $\bar{X}_t$ is a $k \times 1$ vector of variables' means, μ is the mean of the observables over the sample period, β is a $k \times m$ matrix of coefficients, F_t is a vector of $m \times 1$ unobserved common factor and U_t is a $k \times 1$ vector of errors assumed to be mean-zero stochastic processes. The factor F_t, is estimated using the principal component approach which involves minimizing the sum of squared residuals in Equation 2. The Bai and Ng (2002) selection criteria was used to determine the optimal number of common factors. We regress F_t on current and lagged non-hydrocarbon growth to purge any past influences of economic activity on the common factor, such that:

$$F_t = (AL)y_t + \varepsilon_t \qquad (2)$$

Where $(AL)$is the lag operator that captures both the current and past non-hydrocarbon GDP growth rates, y_t is the year-on-year non-hydrocarbon GDP growth rates, and ε_t is the factor-based FCI, which captures only the exogeneous developments in financial conditions that would predict future non-hydro economic activity.

7. For the weighted sum approach, the determination of weights can follow one of two paths. The first assigns equal weights across all variables, resulting in the FCI being calculated as a simple average (Arrigoni and others, 2022). The second method allocates weights based on the variables' estimated impacts on real GDP growth, employing either a vector autoregressive (VAR) model or structural macroeconomic models. We employed the latter using a VAR framework. To this end, and following Swiston (2008), a weighted sum FCI was developed as shown in Equation 3:

$$FCI_t = \sum_{j=1}^{k} w_j (x_{jt} - u_j)\delta_j^{-1} \quad (3)$$

Where, weights were derived from the cumulative impulse-response functions of real non-oil GDP growth following a one-standard deviation shock to each variable. For any given period (t), the FCI was calculated as a weighted average of (k) distinct financial variables, denoted by x_{jt}, where w_j represents the weight assigned to each variable. The mean u_j and standard deviation δ_j of each financial variable were calculated over the sample period. To ensure a consistent scale for comparison and the removal of measurement unit influences, the variables considered were demeaned and standardized. To demean the financial variables, the sample average was subtracted from each variable, and to standardize, the demeaned series was divided by its standard deviation.

8. The choice of financial variables was determined by their significant impact on Qatar's non-hydrocarbon GDP growth. The weight, w_j, measures the relative importance of each financial variable to non-hydrocarbon GDP growth. The weight was estimated from a recursive VAR framework as the cumulative 18 - 24 months the impulse response of real non-hydrocarbon GDP growth to a one-unit shock to x_{jt} for the period 2009 to 2023[2]. Data was converted into monthly frequency using the method developed by Chow and Lin's (1971). Nominal variables were converted to real terms by deflating the variables with the GDP deflator. Following a Cholesky decomposition, the identification of structural shocks assumed that domestic financial conditions do not have contemporaneous effects on growth, and that domestic developments do not contemporaneously affect external variables. Except for interest rates, all variables entered the model as growth rates. A lag length of one was selected for the VAR based on Schwartz Bayesian Criterion (SBC). We used the Augmented Dickey-Fuller tests to confirm the stationarity of the variables.

9. The variables included a combination of global and domestic factors. Global variables represent external financial conditions that could impact Qatar's economy, particularly through the financial sector's exposure to global developments. Domestic variables capture the various channels through which financial conditions affect the real economy. The global factors included a measure of global financial market uncertainty (VIX), the nominal effective exchange rate (NEER) and oil prices. Domestic factors included the real policy deposit rate, real market interest spreads (defined as the difference between real short-term lending rates and real short-term deposit rates), the growth rates

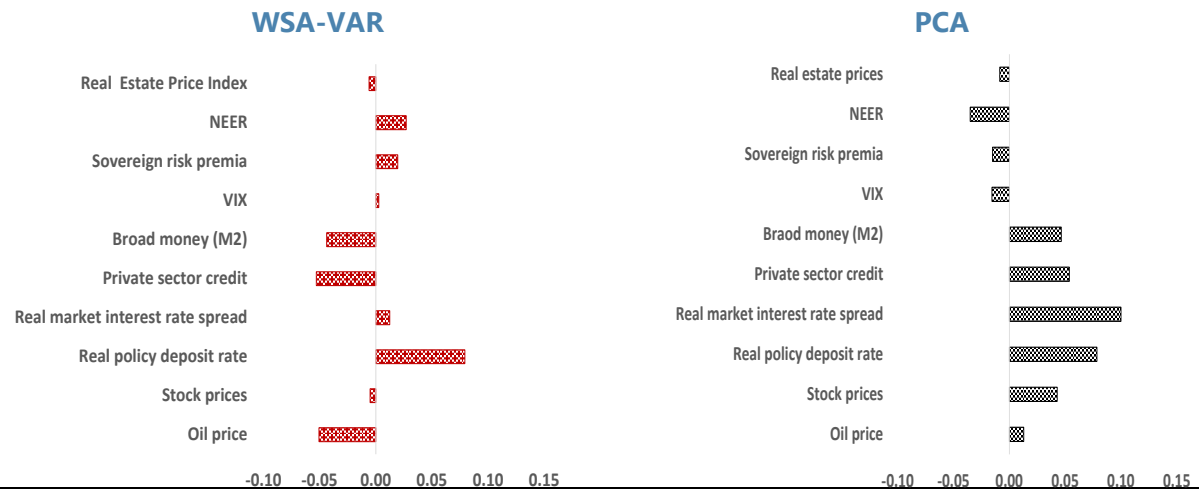
[2] Impulse response functions for the selected financial variables are presented in Annex I.

of credit to the private sector, and money supply (proxied by broad money—M2). Other domestic factors included: the 5-year CDS spread to capture shifts in the sovereign risk premia; as well as stock and real estate price indices to offer insights into the developments within these asset classes.

C. The Financial Conditions Index for Qatar: an Overview

10. The WSA-VAR method yielded more consistent signs than the PCA approach. The weights derived from the VAR framework and the factor loadings obtained from the PCA are shown in figure 1. An increase in the index is interpreted as tightening of financial conditions, while a decrease suggests a loosening of these conditions. This implies that positive values of weights and factor loadings demonstrate a positive correlation with the Financial Conditions Index (FCI), and negative values imply a negative correlation with the FCI. Our prior is that the real policy interest rate, the real market spread, and the risk premium are positively related to the FCI; while money supply, private sector credit, and domestic stock and real estate price indices would be negatively related to the FCI. The impact of exchange rates on financial conditions is multifaceted. For instance, for a country with flexible exchange rate, a depreciation of the exchange rate could increase the local currency cost of dollar-denominated debt, thereby tightening financial conditions. On the other hand, through the traditional trade channel, a weaker domestic currency relative to the currencies of trading partners could ease financial conditions. Given Qatar's exchange rate peg to the US dollar, we expect a positive correlation between exchange rate (appreciation) and financial conditions (tightening). Heightened global financial market uncertainty, measured by the VIX, would lead to tighter financial conditions, while an increase in oil prices is expected to ease financial conditions for hydrocarbon-exporting countries such as Qatar. In the PCA analysis, indicators that contradicted our assumptions were removed, while those with smaller magnitudes were retained. Overall, the WSA-VAR approach yielded more consistent signs than the PCA method.

Text Figure 1. Qatar: Weights from the WSA-VAR and Factor Loadings from the PCA



Source: Haver Analytics, IMF WEO and IMF staff calculations.

11. The results suggest that the WSA-VAR approach outperforms the PCA. The estimated FCIs by the WSA-VAR and PCA methodologies are presented in Figure 2a. The FCIs from both methods broadly follow a similar trajectory, with a correlation of about 0.86. The weighted sum method has been found to effectively capture deep recessions stemming from shocks better than statistical methods such as the PCA (Arrigoni, 2022). Indeed, our results suggest that the WSA-VAR approach outperforms the PCA to predict shocks to financial conditions, particularly during significant shocks such as the oil price shock in 2015, the Covid-19 pandemic in 2020, and the subsequent easing of financial conditions post-pandemic. Furthermore, the WSA-VAR method appears to predict a tightening of financial conditions in 2023 more distinctly than the PCA.

12. The FCI can be decomposed to highlight the individual contributions of financial variables. The decomposition of the FCI into individual contributions of financial variables to the overall FCI is illustrated in Figure 2b. We decomposed the WSA-VAR FCI[3] to showcase variations in the contributions of individual financial variables over the sample period. Significant contributors to fluctuations in the aggregate financial conditions include domestic conditions such as the real policy deposit rate, monetary conditions (including credit and broad money) and external factors driven mainly by oil prices, with the FCI capturing key developments in the financial cycle. For example, during the global financial crisis of 2008–09, financial conditions significantly tightened, as evidenced by tightening equity prices, heightened sovereign risk premia, currency depreciation and a general tightening of the external conditions alongside easy domestic monetary conditions.

Text Figure 2. Qatar: Financial Conditions Index (Z Score)

Figure 2a. Comparison of the WSA-VAR FCI & PCA FCI

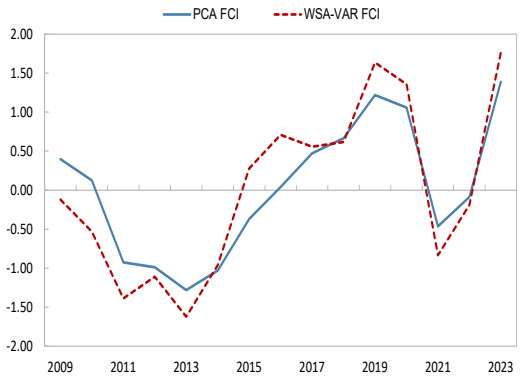
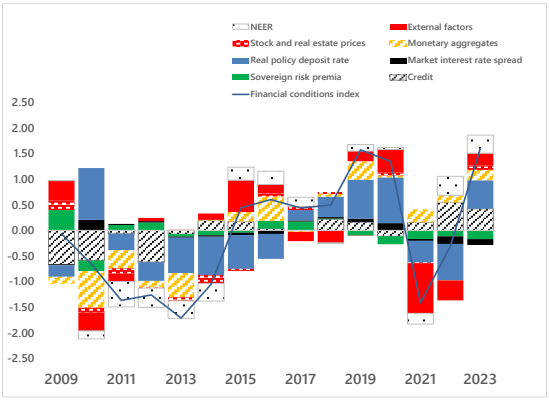


Figure 2b. Decomposition of the WSA-VAR FCI



Source: Haver Analytics, IMF WEO & IMF staff calculations
Notes: 1. A positive sign indicates tightening in the FCI, while a negative sign an easing.
2. All the variables are demeaned and standardized.
3. External factors include oil prices, VIX and nominal effective exchange rate (NEER).

[3] Decomposition of the FCI under the WSA-VAR methods is simple and straight forward compared to the PCA method (see also Arrigoni, 2022). Moreover, the WSA-VAR FCI better predicts the historical developments in Qatar's financial sector than the PCA FCI.

13. The estimated FCI reflects a trend of eased financial conditions from 2010 to 2014, aligning with the post-global financial crisis recovery phase. A recovery after 2010 was disrupted by the oil price collapse starting in 2014 that led to another wave of tight financial conditions. Tight financial conditions persisted through 2020, compounded by the regional blockade in 2017 and the covid-19 shock. A brief period of post-pandemic easing in financial conditions followed (2021–2022), as elevated hydrocarbon prices brought in significant liquidity and the nominal increases in policy deposit rate in 2022 offset by higher inflation related to the World Cup. Financial conditions tightened again in 2023 as the real policy deposit rate increased (with lower inflation), hydrocarbon prices softened and the global financial conditions deteriorated.

14. External conditions affecting Qatar's economy are predominantly shaped by fluctuations in oil prices. The major oil price cycles, notably the downturns in 2014 and 2020, as well as the subsequent recovery phase during 2021-2022, align with periods of tightened and eased financial conditions, respectively. The sovereign risk premia also closely captures significant developments, including the diplomatic rift with neighboring countries in 2017, which resulted in wider sovereign risk spreads, a downturn in stock market prices, and an overall tightening of financial conditions (see Annex 2 for details).

15. The FCI tracks non-hydrocarbon real GDP growth and the Qatar Central Bank (QCB)'s bank lending survey closely. The FCI demonstrates a relatively strong (negative) correlation with real non-hydrocarbon real GDP growth, signaling potential leading indicator properties of non-hydrocarbon economic activity, with a correlation of about -0.66 (figure 3a). Furthermore, the credit conditions component of the FCI closely mirrors the index from QCB's bank lending survey, as depicted in figure 3b. Analyzing the impact of the FCI on real non-hydrocarbon growth, the impulse response functions presented in figures 3c and 3d indicate that tight financial conditions negatively affect both inflation and non-hydrocarbon GDP growth, as expected.[4]

[4] Our estimates show that tightening FCIs can reduce inflation on average by 0.3 and up to 0.5 percentage points after 2 years; and lead to a contraction in output by 0.8 to 1.0 percentage points, which is in line with the literature (Borracia and others, 2023).

Text Figure 3. Qatar: Evaluation of the FCI

Figure 3a. FCI and Real Non-hydrocarbon GDP Growth

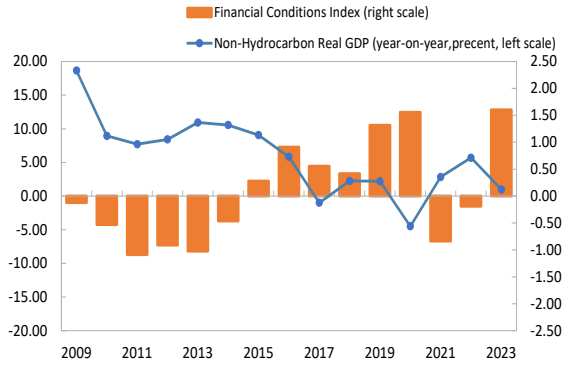


Figure 3b. Bank Lending Survey & the Private Sector Credit Conditions Index

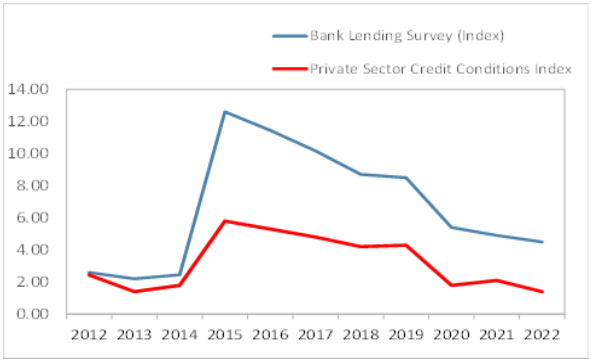


Figure 3c. Response of CPI Inflation to a Positive Shock in the FCI

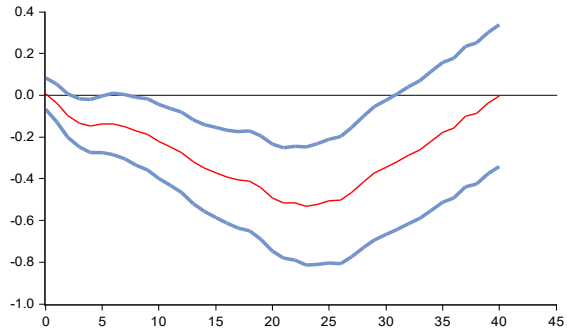
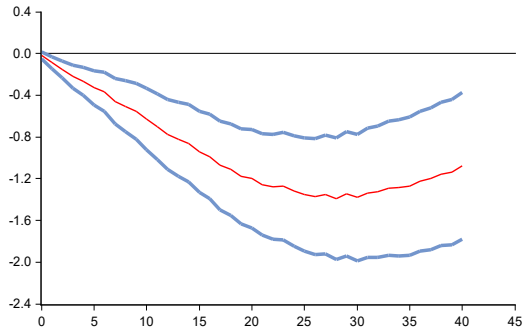


Figure 3d. Response of Non-hydrocarbon Real GDP Growth to a Positive Shock in the FCI



Source: Haver Analytics, IMF WEO, Qatar Financial stability Review, 2022 & IMF staff calculations
Note: A positive sign indicates tightening in the FCI, while a negative sign an easing.

D. Impact of Financial Conditions on Non-hydrocarbon Growth

16. Financial conditions can provide important signals about risks to future economic performance. The Growth-at-Risk approach links macro-financial conditions to the probability distribution of future GDP growth. Its primary strength lies in its ability to encompass the full spectrum of growth distribution, allowing for the assessment of both downside and upside risks. This approach not only allows for a comprehensive analysis of the key drivers of future GDP growth, it also helps to quantify the impact of risk on future GDP growth (Busch and others, 2022). Recent studies have demonstrated that financial conditions are significant predictors of GDP growth risks over both short and medium term, but these predictive effects tend to diminish over longer term horizons (IMF GFSR 2017b; Prasad et al.,2019 and Busch and others, 2022).

17. The GaR methodology involves three key steps. Based on the Growth-at-Risk excel toolkit developed at the IMF (see Prasad, 2019 for details), our estimation approach followed three key steps. First, financial conditions indicators were partitioned into a predetermined number of subgroups using the linear discriminant analysis (LDA), a data reduction technique. Second, a model of future output growth was estimated as a function of current economic conditions and the partitioned financial conditions indicators using quantile regressions. Finally, the conditional quantile function (or inverse cumulative distribution function) was transformed into a probability density function by fitting a skewed t distribution. This probability density function was then exploited to quantify downside tail risks to future GDP growth.

18. The financial conditions indicators were partitioned into three subcomponents: domestic conditions (real policy deposit rate, real market interest spread, money supply, stock prices, real estate prices, and the sovereign risk premia), credit conditions (which included credit growth and credit- to- non-hydrocarbon GDP gap[5]) and external conditions (VIX, oil prices and the nominal effective exchange rate (NEER))—see annex table 1 for the variable classification. These financial variables were partitioned using the LDA approach, which links them with GDP growth during the dimensionality reduction process. Following this, FCIs for the three subcomponents, along with an overall FCI were estimated. The FCI generated via the GaR approach aligns closely with the FCIs estimated through the WSA-VAR and the PCA approaches, showing a bias toward the WSA-VAR FCI (see figure 4a). Also, as depicted in figure 4b, the FCIs for domestic, credit and external conditions accurately reflect developments in Qatar's financial sector since 2009, with domestic conditions, and external conditions dominating the FCI.

19. Financial conditions indicators were mapped on a probability distribution of future growth outcomes. Following the approach in IMF 2017b, the conditional density forecast of future GDP growth on current financial, credit and external conditions was estimated using quantile regressions:

$$Q\left(y_{t+h},q\right) = \propto_y^q y_t + \propto_p^q dom\_cond_t + \propto_c^q credit\_cond_t + \propto_e^q ext\_cond_t + \varepsilon_{t,h}$$

The quantile regressions regress future GDP growth on current growth (y_t), domestic conditions (dom_cond), credit conditions (credit_cond) and external conditions (ext_cond), where q indicates the quantile level and h the forecast horizon (in quarters). The regression is fitted on a set of quantiles (0.10, 0.25, 0.50, 0.75, 0.90) for forecast horizons of 4, 8 and 12 quarters, to consider the impact of financial conditions on non-hydrocarbon growth density forecasts at different horizons. The domestic conditions, credit conditions, and external financial conditions are included separately in the quantile regressions to investigate the relative significance of each dimension of financial conditions for signaling risks to the near- and medium-term growth outlook.

[5] Credit to non-hydrocarbon GDP gap was defined as the deviation of the credit-to-non-hydrocarbon GDP ratio from trend. It was computed using Hodrick-Prescott filter. Results were robust to using the credit impulse, defined as the ratio between the annual change in credit and the nominal non-hydrocarbon GDP of the previous year.

Text Figure 4. Qatar: Financial Conditions Index—GaR Approach

Figure 4a. Comparison of FCIs (WSA-VAR, PCA & GaR)

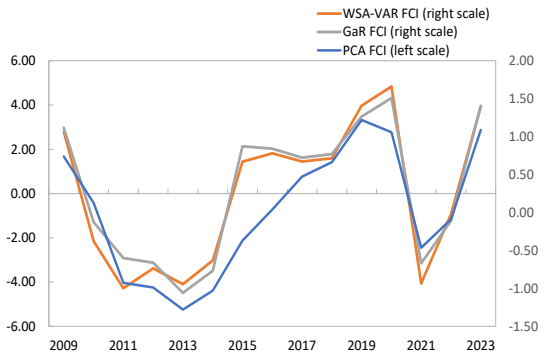
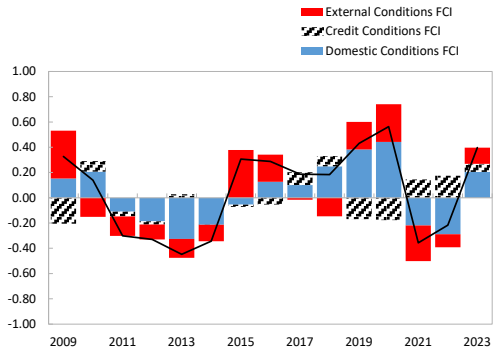


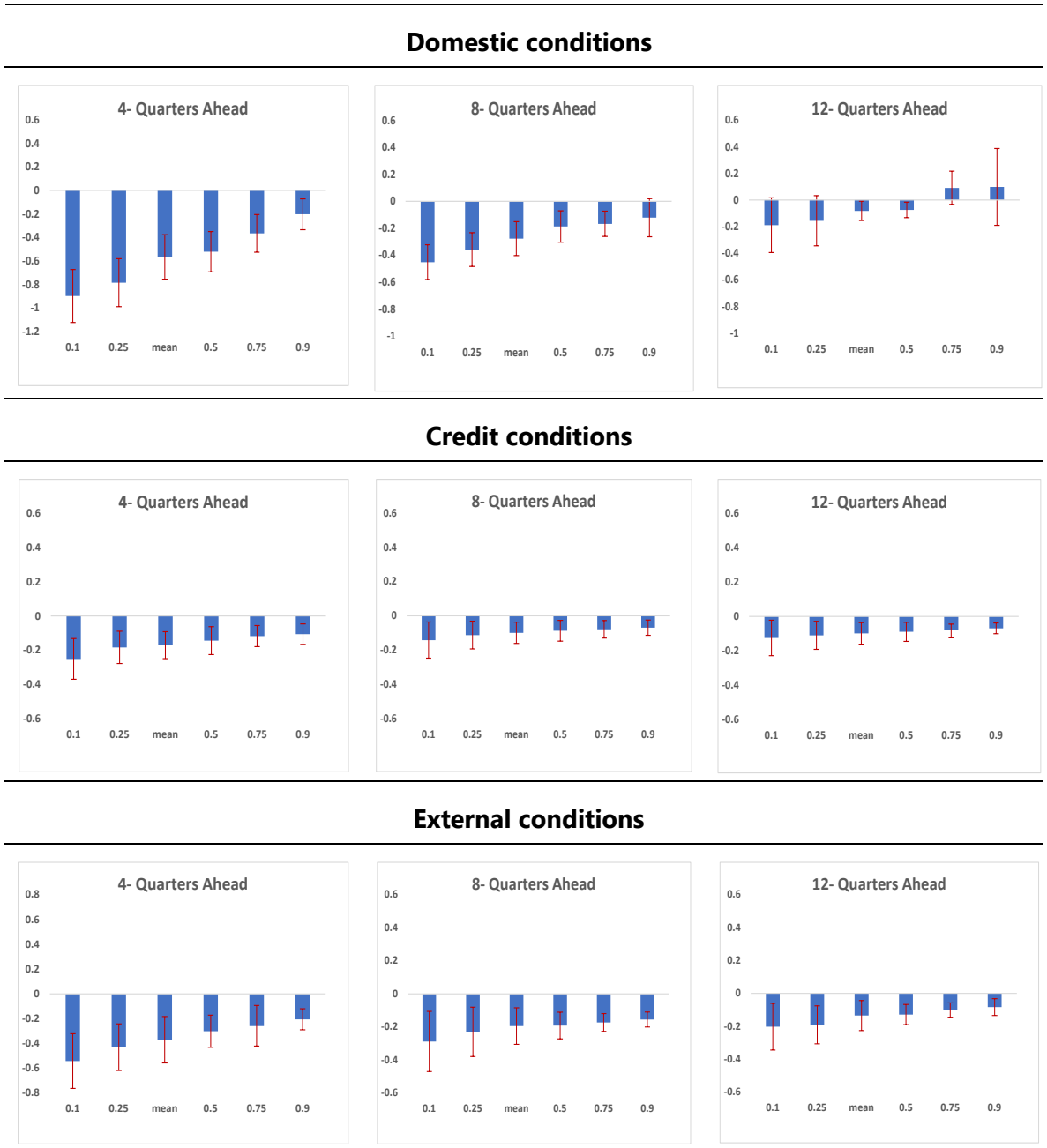
Figure 4b. Decomposition of the GaR FCI



Source: Haver Analytics, IMF WEO, and IMF staff calculations
Notes: A positive sign indicates tightening in the FCI, while a negative sign an easing.

20. Both domestic and external conditions matter for growth of the non-hydrocarbon sector. The quantile regression results shown in Figure 5 indicate that tight domestic conditions, primarily driven by high short-term interest rates, have a more pronounced effect on the non-hydrocarbon growth outlook, resulting in a decline in the lower quantiles of the GDP growth distribution over the next 4 to 8 quarters. This suggests that the tightening of domestic conditions is likely to shift the non-hydrocarbon GDP distribution to the left than around the median, reflecting asymmetrical output responses to changes in these conditions. This effect tends to diminish over longer periods as conditions improve. While its impact is relatively minor, the deterioration of credit conditions—due to high funding costs and subdued demand—has led to credit growth falling below potential, contributing to short-term risks; however, these effects are anticipated to lessen in the medium term as conditions improve. Additionally, tight external conditions, mainly caused by fluctuations in commodity prices, had a significant negative impact on the overall outlook for non-hydrocarbon growth. These findings align with other studies (IMF GFSR, 2017b chapter 3, Adedeji et al., 2019 for GCC).

Text Figure 5. Qatar: Coefficients from Quantile Regressions of Financial Conditions on Future Non-Hydrocarbon GDP Growth.



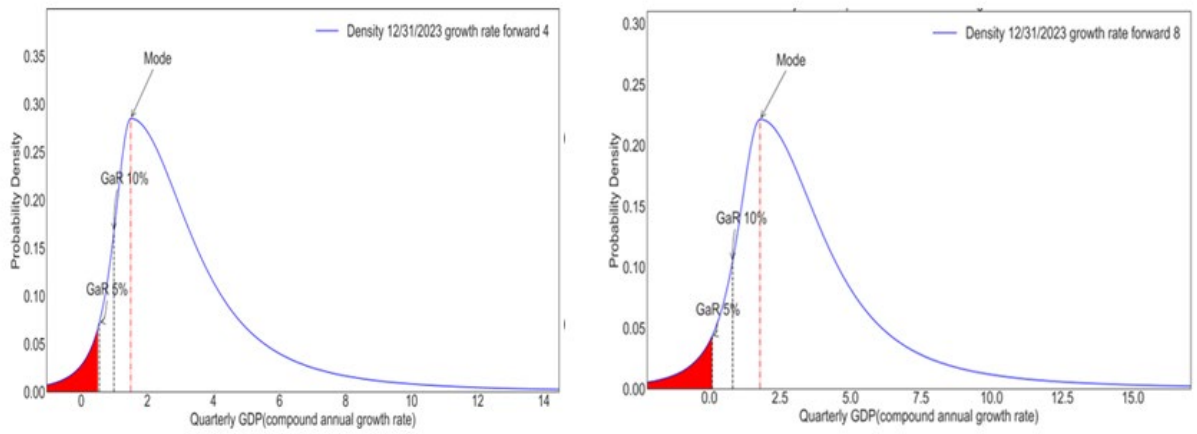
Source: Haver Analytics, IMF WEO, and IMF staff calculations

Notes: Panel A reports the coefficients with their corresponding 95% confidence intervals from a regression of GDP growth against domestic conditions. Panel B shows the results from the same estimation for credit conditions. Panel C shows the results for external conditions. The x -axis represents the non-hydrocarbon GDP growth quantiles corresponding to each coefficient, whose scale is depicted in the y -axis.

21. To quantify downside tail risks to Qatar's future non-hydrocarbon growth, a t-skewed distribution was fitted on the empirical conditional quantile function for each forecast horizon. The detailed methodology is discussed in IMF (2017b). The distributions were calibrated so that the mode (the most likely outcome) is consistent with IMF staff's baseline forecast for Qatar's non-hydrocarbon growth, which is set at [1.5] percent for 2024 and [1.9] percent for 2025. By employing the t-skewed fitted curve approach, a probability density function was derived for Qatar's future non-hydrocarbon growth, for 4 and 8 Quarters ahead (i.e. 2024 and 2025).

22. The GaR model suggests only mild risks surrounding the baseline projection for Qatar's non-hydrocarbon growth. Under the current IMF staff's baseline distribution, the maximum expected non-hydrocarbon growth rate that would be realized in a severely adverse growth scenario, if GDP growth falls below the 5th percentile of its expected distribution would be 0.5 percent and 0.1 percent in the 4 Quarters and 8 quarters ahead, respectively. This suggests a relatively mild risk outlook for the short- to medium term (refer to figure 6 below).

Text Figure 6. Qatar: Probability Densities of GDP Growth Four and Eight Quarters Ahead



Source: IMF staff calculations

23. The GaR model can also be used to assess how shocks to selected variables are likely to affect the distribution of future growth.

- **Impact of monetary policy easing:** Policy rates in Qatar generally follow the US Fed rates, consistent with the peg to the US dollar[6]. In line with the US Fed funds rate easing cycle, we assumed a 100 basis-point reduction in the policy deposit rate by end of 2024, while holding the other factors constant[7]. Results in figure 7 show that a 100 basis-point reduction in the policy deposit rate improves average future growth with the rightward shift in the peak of future growth distribution, with a significant reduction in the GaR at 5% percentile growth. Results also

[6] The QCB reduced the policy rate by 0.55 bp following the 0.5bp cut in the US Fed rate in September 2024.

[7] We expect the shocks to propagate to the future growth distribution in a non-linear way, as the beta coefficients differ by quantile.

indicate that, in line with other studies, the maximum impact of accommodative conditions would be realized in the near term (around 0.4 percentage points higher), whereas effects tend to dissipate in the long term (IMF GFSR, 2017b, IMF 2019 and Adedeji and others, 2019 for GCC).

Text Figure 7. Qatar: Impact of a 100 Basis-Point Reduction in the Policy Deposit Rate

Figure 7a. 8 Quarters Ahead

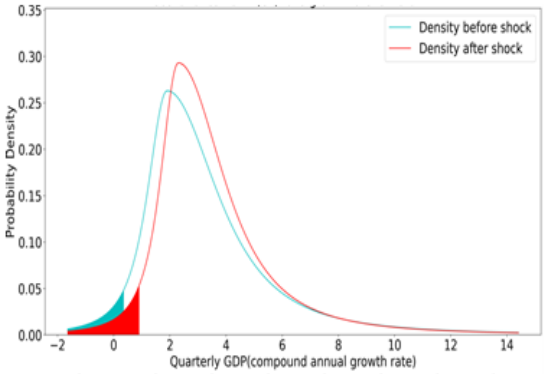
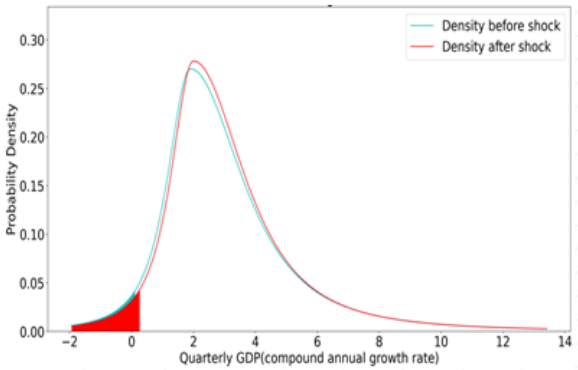


Figure 7b. 12 Quarters Ahead



Source: IMF staff calculations

- **Impact of external conditions:** As a commodity exporter, Qatar is susceptible to volatility in commodity prices and global uncertainty. As such, we applied one-standard deviation shocks to oil prices and VIX (measure of global financial market uncertainty), separately, while holding other factors constant. A negative shock to oil prices would aggravate risks to non-hydrocarbon growth outlook leading to a leftward shift in the peak of future growth distribution. The magnitude of the shock could cost about 0.3-0.4 percentage points non-hydrocarbon growth for Qatar, with GaR at 5 percent declining to about -0.1, implying an elevation of risks to the outlook (figure 8a). This is in line with other studies on GCC (see for example Adedeji and others, 2019). Results also suggest that global financial market uncertainty could amplify downside risks to future non-hydrocarbon GDP growth. Although its impact is marginal[8], results in figure 8b show that the VIX leads to a leftward shift in the peak of the future growth distribution and GaR slightly worsens.

[8] This could be attributed to relatively less developed financial markets in Qatar, leading to a small contribution of the VIX to non-hydrocarbon growth (annex 1). The impact could be higher with a measure that captures the entire spectrum of global uncertainty. Yet, the VIX only captures global financial market uncertainty (for details see Chapter 2 GFSR October 2024).

Text Figure 8. Qatar: Impact of a Reduction in Oil Prices and Increase in Global Financial Market Uncertainty.

Figure 8a. Oil Prices

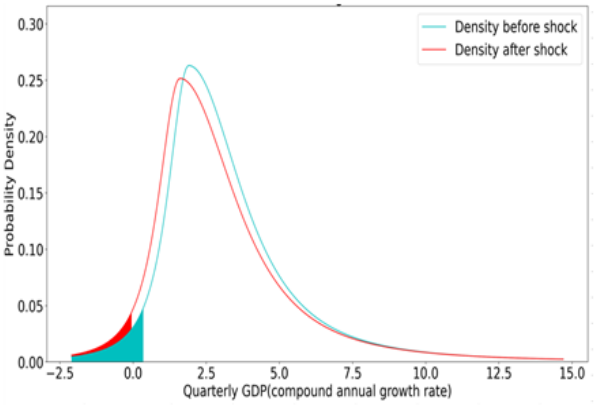
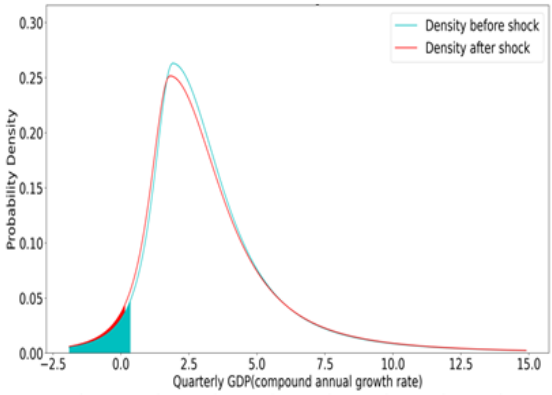


Figure 8b. Global Financial Market Uncertainty (VIX)



Source: IMF staff calculations

E. Conclusions

24. This paper develops a financial condition index for Qatar using different approaches. The FCIs derived from the WSA-VAR, PCA, and GaR approaches are closely aligned and exhibit a high correlation. As Qatar seeks to enhance the financial sector's contribution to growth through the Third Financial Sector Strategy, a financial conditions index will be essential for assessing the current state of financial conditions and evaluating the relationship between financial indicators and future growth distribution.

25. The analysis shows that the financial conditions index is an important leading indicator of Qatar's non-hydrocarbon growth and closely follows QCB's bank lending survey. The FCI exhibits a relatively strong correlation with real non-hydrocarbon GDP growth, highlighting its predictive potential for future economic performance. Additionally, the credit conditions component of the FCI aligns with the QCB's bank lending survey, indicating consistency of our FCI with other surveys.

26. The GaR analysis highlights the importance of domestic and external conditions as indicators of real non-hydrocarbon GDP growth performance. Domestic conditions seem to offer the strongest signal in the short term, whereas the effects of external conditions are significant in both the short and medium term. Overall, the current downside risks to Qatar's baseline non-hydrocarbon growth projections are relatively mild. Alternative scenario tests indicate that future non-hydrocarbon growth could improve following a reduction in the policy deposit rate. Additionally, non-hydrocarbon growth is primarily influenced by oil prices, with minimal effects stemming from global financial market uncertainty.

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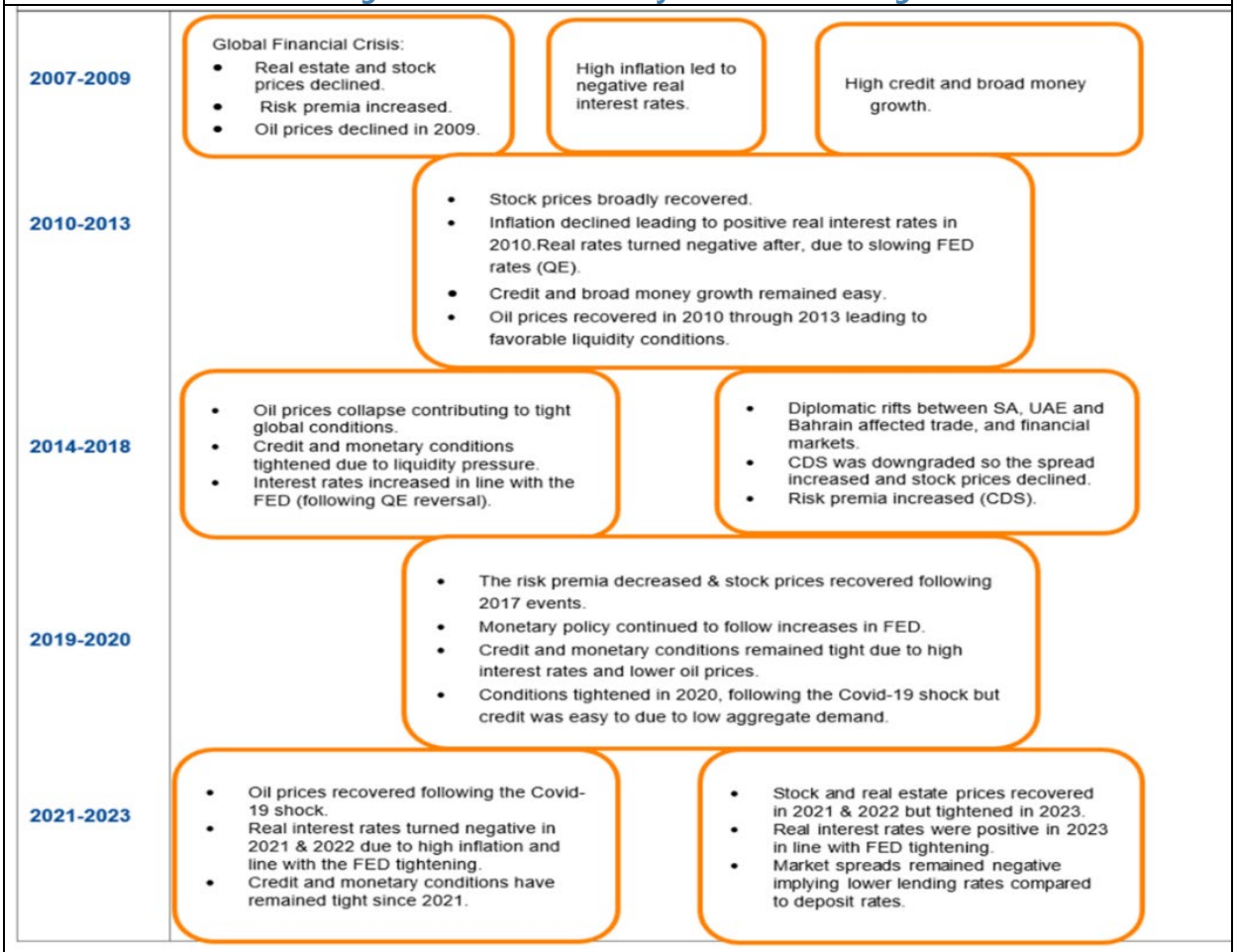
Annex I. Response of Real Non-Hydrocarbon GDP Growth to Shocks from Selected Financial Variables

Source: IMF staff calculations

Annex II. Summary of Factors Driving the FCIs

Annex II. Figure 1. Qatar: Summary of Factors Driving the FCIs



Source: IMF Qatar Article IV Staff Reports 2007-2023

Annex II. Table 1. Qatar: List of Partitioned Financial Variables

Domestic conditions	Credit conditions	External conditions
▪ real policy deposit rate ▪ real market interest spread. ▪ Broad money (M2) ▪ stock prices ▪ real estate prices ▪ sovereign risk premia	▪ credit growth (y/y), ▪ credit- to- non-hydrocarbon GDP gap /credit-to-non-hydrocarbon impulse	▪ oil price ▪ VIX ▪ nominal effective exchange rate (NEER)

Source: Haver Analytics, IMF WEO and S&P.

ESTIMATING FISCAL MULTIPLIER FOR QATAR[1]

Econometric results suggest that Qatar's strong capital spending multiplier became less impactful as the stock of capital rose to a high level, likely as the marginal impact declined. This supports Qatar's strategy to shifts the State's role to an enabler of private sector-led growth, focusing on expenditure to support build human capital and implementation of broader reform guided by the Third National Development Strategy.

A. Introduction

1. Spending by the State of Qatar has helped built the nation's LNG production/export capacity and broader infrastructure, driving economic growth and diversification (Figure 1). In the early 1990s, the State developed a multi-directional and fast-track strategy to accelerate the commercialization of Qatar's substantial natural gas reserves to diversify and ultimately modernize the economy.[2] The State has made large-scale investments across the entire value chain of LNG trains, tankers, and storage and receiving facilities, becoming one of the leading LNG producing countries in the world. To prepare for the 2022 FIFA World Cup and develop Qatar's infrastructure more broadly, public sector expenditure on major infrastructure projects increased—top-notch infrastructure has been built including the Lusail real estate development, Hamad International Airport, Hamad Port, the Doha Metro and other transportation and social infrastructure. Long-term contributions of such spending were significant—the large investment in general infrastructure ahead of the World Cup is estimated to have driven much of the non-hydrocarbon sector's growth in the past decade (Biboliv et al., 2024).

2. At the same time, the State has taken measures to improve spending efficiency. The State budget focuses on sustainable development in line with the key pillars of the Qatar National Vision 2030 including economic, social, human and environmental development. Current expenditure reforms focused on subsidies, travel and office expenses, non-core services (outsourced to the private sector), and GRE activities (e.g., Al Jazeera and Qatar Museums). In response to the pandemic, health expenditure rose but spending in other areas were contained. Capital expenditure proposals and budget requests are closely scrutinized on an ongoing basis.

3. In addition, the State is in the process of reducing its footprint and enabling private sector development. The private sector historically played a limited role. The State has undertaken regulatory reforms to support firm creation, competition, and FDI. The telecommunications sector was liberalized, and special economic zones were created. In recent years, the responsibility for certain projects in the real estate, education and healthcare sectors was outsourced to the private

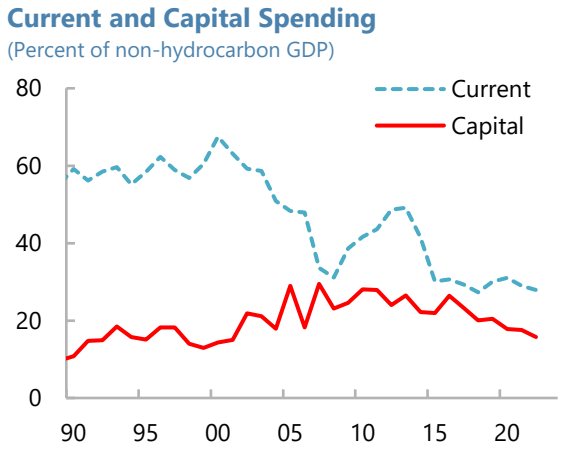
[1] Prepared by Ken Miyajima. The author would like to thank the participants of the IMF 2024 Article IV Workshop at the Ministry of Finance for their helpful suggestions and comments.

[2] This strategy was implemented on a three-pronged approach by developing (i) LNG and GTL for global export, (ii) pipeline gas for regional export, and (iii) pipeline gas for domestic petrochemicals, power generation plants, and industrial consumption.

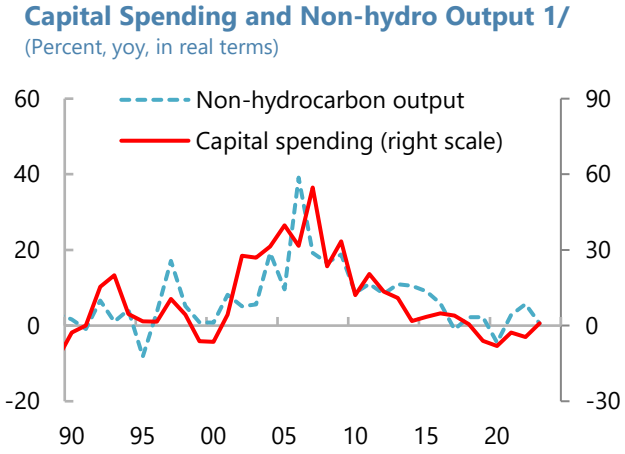
sector. Qatar Energy launched a program to increase localization of the energy sector's supply chain by creating local support services and industries, including SMEs. New legislation on public-private partnerships facilitates the financing of new schools, medical centers and other infrastructure projects by the private sector. The Third National Development Strategy (NDS3) was released in January 2024 to intensify transition to private sector-driven growth. The state is set to become an enabler to facilitate this transition, using public spending to support NDS3 reforms.

Text Figure 1. Qatar: Central Government Spending and Non-hydrocarbon Output

State's current spending has fallen while capital spending has been more stable.



Capital spending growth and non-hydrocarbon output growth have evolved in tandem.



Sources: Haver and IMF staff.
1/ Capital spending real growth in 3-year moving average.

4. To inform spending allocation decisions to support NDS3 goals, this paper estimates the impact of fiscal spending on non-hydrocarbon output in Qatar. The so-called fiscal multiplier can be used to gauge the efficiency of given fiscal expenditure in terms of non-hydrocarbon output growth. Our empirical strategy involves two approaches. The first approach is to use data for a panel of GCC countries to gauge the GCC-wide trend, and from there tease out Qatar-specific effects. The second approach complements the first by relying on single-country time-series data for Qatar to estimate both static and dynamic equations. Elasticity estimated this way can be converted to fiscal multiplier after dividing it by the ratio of spending level to non-hydrocarbon output level (average over the estimation horizon).

5. The rest of the paper is structured as follows. Section B estimates fiscal multiplier using a panel approach for the GCC while section C does so using a single-country approach for Qatar. Section D concludes with discussions.

B. Estimating Fiscal Multipliers: A GCC Panel Approach

Estimation Strategy and Data

6. The baseline model is standard in the literature. Following Espinoza and Senhadji (2011) and Fouejieu et al. (2018), the linear model takes the form of equation (1).

$$y_{i,t} = \alpha + \beta_j \sum_i x_{i,j,t} + \gamma_k \sum_k z_{k,t} + \delta_i + \varepsilon_{i,t} \quad (1)$$

The dependent variable $y_{i,t}$ is the real growth rate of non-hydrocarbon output of country i in time t. The independent variables $x_{i,j,t}$ are the real growth rates of central government spending—total, current, and capital spending (j=1,2,3). Control variables $z_{k,t}$ are the real growth rates of global output and oil prices (k=1,2). δ_i and $\varepsilon_{i,t}$ are the time-invariant country fixed effects and error term. α, β, γ are parameter to be estimated. Regressions are estimated with and without the UAE based on Fouejieu et al. (2018) who conjecture that GREs may play a large role in total public spending.

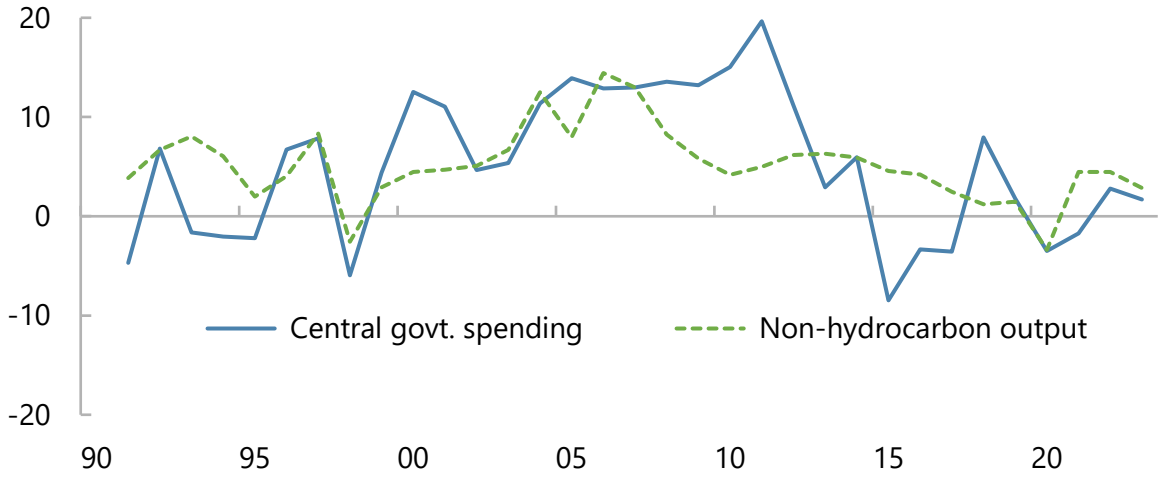
7. The baseline model is extended in two directions. First, we assess whether fiscal multiplier on capital spending could have declined as the level of capital stock rose. Fouejieu et al. (2018) argue that fiscal consolidation in the GCC may be less costly as fiscal multiplier declined over time. Indeed, the stock of public sector capital is large in Qatar, with room for improving investment efficiency, along with other GCC countries (IMF, 2023a). The baseline model is extended to, first, include an indicator of capital stock. Second, Qatar-specific coefficients are estimated by using the Qatar country dummy, while exploiting information from other GCC countries' data.

8. Annual data used span three decades. Data for output, central government spending, and oil prices span 1990–2023 for 6 GCC countries. Some data for 2023 are estimates taken from the latest IMF's World Economic Outlook at the time of estimation. The stock of capital is taken from Penn World Table, available up to 2019 (2020–23 data are extrapolated).

9. Real growth rates of non-hydrocarbon output and central government spending exhibit relatively strong correlation in the GCC. Visually, growth rates of output and total spending moved more in tandem up to the late-2000s than afterwards (Figure 2). The degree of co-movement rose since the COVID-19 pandemic. Correlation coefficients for the entire sample period between output growth and total spending are statistically significant for the GCC (Table 1).

10. Correlation coefficients vary across countries and spending components (Table 1). At the country level, correlation coefficients are most significant for Qatar, followed by Oman and Saudi Arabia. Correlation is negative for the UAE, consistent with Espinoza and Senhadji (2011) and Fouejieu et al. (2018). Within total spending, current spending tends to have more immediate effects, while those of capital spending tend to emerge with a lag and last longer.

Text Figure 2. Qatar: GCC: Non-hydrocarbon Output and Central Government Spending
(Percent, yoy, real growth)



Sources: Haver, IMF WEO, and IMF staff calculations.

Text Table 1. Qatar: Correlation between Non-hydrocarbon Output Growth and Central Government Spending Growth, 1990-2023 1/

	Lag	GCC	BHR	KWT	OMN	QAT	SAU	UAE
Total	0	0.2140**	0.1318	0.2658	0.2666	0.5530**	0.4215*	-0.1322
	1	0.2267**	0.0688	-0.3695	0.3734*	0.5724**	0.305	-0.3824*
	2	0.1879*	0.3039	-0.3668	0.3535	0.5643**	0.1233	-0.2521
	3	0.1970*	0.209	0.5659	0.2037	0.3734*	0.2912	-0.1205
Current	0	0.1948**	0.1102	0.1978	0.2225	0.4949**	0.3438	-0.1246
	1	0.1234	0.0997	-0.1026	0.2973	0.343	0.218	-0.3832*
	2	0.1424	0.1617	-0.265	0.289	0.3875*	0.0386	-0.2799
	3	0.1388	0.1673	0.0159	0.1166	0.3008	0.202	-0.1169
Capital	0	0.1383	0.0953	0.1393	0.1163	0.2513	0.4085*	-0.0633
	1	0.2536**	0.0175	-0.577	0.2997	0.5981**	0.3530*	-0.173
	2	0.2226**	0.3957*	-0.0898	0.2683	0.4863**	0.2413	0.0283
	3	0.2171**	0.17	0.7904*	0.2827	0.3083	0.3640*	-0.0076

Sources: Haver, IMF WEO, and IMF staff calculations.
1/ * and ** signify statistical significance at the 5 and 1 percent levels.

Estimated Results

11. Baseline regression results broadly confirm the earlier observations (Table 2). Real growth of central government total spending is significantly impacting that of non-hydrocarbon output in the GCC with lags (model 1). When only current spending is used, coefficients are

significant with one year lag and the implied fiscal multiplier is 0.2 (model 2).[3] Capital spending has significant effects with longer lags, where implied long-term fiscal multiplier is close to 0.9 (model 3).[4] When both current and capital spending are included, current spending loses significance while fiscal multiplier of capital spending falls somewhat to 0.7 (model 4). Looking at control variables, the impact of oil prices is significant when introduced without global output growth, suggesting that oil prices are closely associated with global output growth (model 4). Global output growth affects non-hydrocarbon economic activity in the GCC (models 1–3, 5). When the UAE is excluded, effects of current and capital spending on non-hydrocarbon output strengthens (models 6–9).

Text Table 2. Qatar: GCC: Determinants of Non-Hydrocarbon Output, Baseline 1/

		Whole sample					Excluding the UAE			
Model		1	2	3	4	5	6	7	8	9
	Lag									
Total spending	0	0.059*	..	..	..	..	0.085**	..	..	..
	1	0.143***	..	..	..	..	0.199***	..	..	..
	2	0.075**	..	..	..	..	0.121***	..	..	..
Current spending	0	..	0.071*	..	0.044	0.052	..	0.104**	..	0.084**
	1	..	0.099***	..	0.064*	0.059*	..	0.145***	..	0.096**
	2	..	0.062*	..	0.029	0.027	..	0.110***	..	0.065
Capital spending	0	..		0.022	0.015	0.011	..	..	0.024	0.006
	1	..		0.059***	0.049***	0.047***	..	..	0.080***	0.058***
	2	..		0.045***	0.039**	0.038**	..	..	0.057***	0.045***
Global output	0	0.014***	0.015***	0.014***	…	0.014***	0.012***	0.013***	0.011***	0.011***
Oil prices	0	-0.016	-0.024	-0.016	0.042**	-0.02	-0.009	-0.023	-0.006	-0.012
N		175	175	175	175	175	145	145	145	145
R^2		0.283	0.231	0.268	0.196	0.291	0.363	0.285	0.306	0.365

Sources: Haver, IMF WEO, and IMF staff calculations.
1/ The dependent variable is real growth of non-hydrocarbon output. The independent variables are all in real growth rates. To obtain implied fiscal multiplier, divide estimated elasticity by the ratio of the level of a particular spending item to non-hydrocarbon out level.

12. The growth impact of capital expenditure is smaller when the stock of capital reaches higher levels in the GCC (Table 3; coefficients on capital spending represent total impact). The stock of capital is scaled by GDP (both data are taken from Penn World Table) and ranked for each country, and further categorized into low, medium, and high. In particular, capital stock to GDP is "high" 1/3 of the time. Generally speaking, the stock of capital relative to GDP rose over time, except for the United Arab Emirates (Figure 3). Looking at model 10, when capital stock level is not accounted for the coefficients on lagged capital stock (reported under "Overall") are consistent with those of the baseline model (model 5). Remaining on model 10, these coefficients (representing the total impact, not just the interaction term) become statistically insignificant when the capital stock to GDP ratio is high (dummy takes value of 1). The results are broadly unchanged when the threshold

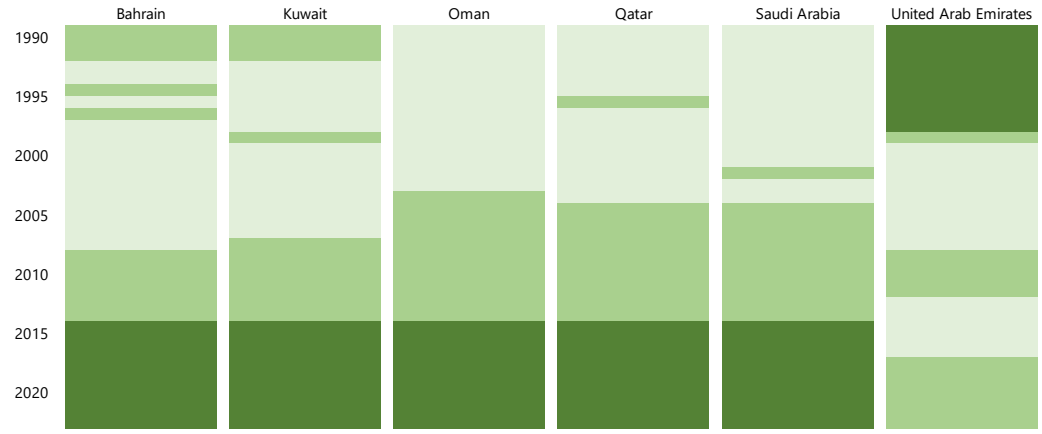
[3] Elasticity of 0.1 over the average current spending to non-hydrocarbon output ratio of 0.47.

[4] Sum of two elasticities is divided by the average capital spending to non-hydrocarbon output ratio of 0.12.

for the "high" dummy is lowered such that capital stock to GDP is "high" for ½ of the time (model 11). Consistent with Fouejieu et al. (2018), the growth impact of capital stock weakens during the second half of the sample period (model 12). Results are generally unchanged when the UAE is dropped, even though current spending becomes more impactful in raising growth.

Text Figure 3. Qatar: Indicator of Stock of Capital Relative to GDP

(Country-level ranking, categorized in low, medium, and high, the higher the darker color)



Sources: Penn World Table and IMF staff calculations.

Text Table 3. Qatar: GCC: Determinants of Non-Hydrocarbon Output, Extension

(Estimated coefficients)

		Whole sample				Excluding the UAE			
Model		5	10	11	12	9	13	14	15
		Baseline	By capital to GDP H = top 1/3	By capital to GDP H = top 1/2	By period	Baseline	By capital to GDP H = top 1/3	By capital to GDP H = top 1/2	By period
	Lag								
Current spending	0	0.0524	0.0512	0.0591	0.0572	0.0841**	0.0833*	0.0836*	0.0862**
	1	0.0586*	0.0553	0.0575	0.0635*	0.0960**	0.0864**	0.0965**	0.0997**
	2	0.0268	0.0286	0.0235	0.0253	0.0648	0.0673*	0.0578	0.0547
Capital spending (total coefficients)									
Overall	0	0.0114	0.0118	-0.0134	0.0028	0.0063	0.0086	-0.0119	0.0041
	1	0.0468***	0.0586***	0.0644***	0.0673***	0.0582***	0.0751***	0.0736***	0.0578**
	2	0.0375**	0.0410**	0.0480*	0.0870***	0.0452***	0.0475**	0.0577**	0.0835**
Capital stock is high	0	…	0.0159	0.0361*	…	…	0.0099	0.0316	…
	1	…	-0.0004	0.0321	…	…	-0.0017	0.0392	…
	2	…	0.0333	0.0291	…	…	0.0351	0.0319	…
Second half	0	…	…	…	0.0169	…	…	…	0.0174
	1	…	…	…	0.0309*	…	…	…	0.0538**
	2	…	…	…	0.0181	…	…	…	0.0292
Global output	0	0.0141***	0.0148***	0.0137***	0.0135***	0.0114***	0.0121***	0.0109***	0.0109***
Oil prices	0	-0.0203	-0.0257	-0.0175	-0.0220	-0.0122	-0.0219	-0.0096	-0.0140
Constant		-0.0120	-0.0153	-0.0112	-0.0110	-0.0130	-0.0170	-0.0115	-0.0117
Observations		175	175	175	175	145	145	145	145
R-squared		0.291	0.303	0.314	0.322	0.365	0.382	0.382	0.377

Sources: Penn World Table and IMF staff calculations.

13. Similarly, the strong growth impact of capital spending in Qatar weakens when capital stock is relatively high (Table 4; coefficients on capital spending represent total impact). Earlier models are further extended by introducing the Qatar country dummy to additionally tease out Qatar-specific effects. Results from model 16 show that for Qatar, estimated elasticity without distinguishing capital stock level implies long-run fiscal multiplier is close to 1.5 (it is insignificant for the GCC countries). When capital stock is relatively high, capital spending does not have significant growth effects (model 17). When the UAE is excluded from the sample, fiscal spending in the GCC becomes more impactful generally but Qatar specific elasticities are broadly unchanged (models 18 and 19).

Text Table 4. Qatar: GCC and Qatar: Determinants of Non-Hydrocarbon Output, Extension
(Estimated coefficients)

		Whole sample			Excluding the UAE		
Model		5	16	17	9	18	19
		Baseline	GCC and Qatar		Baseline	GCC and Qatar	
			Overall	By capital stock		Overall	By capital stock
	# of lag						
Current spending							
GCC	0	0.0524	0.0390	0.0449	0.0841**	0.0662	0.0756*
	1	0.0586*	0.0611*	0.0594*	0.0960**	0.0988**	0.0978**
	2	0.0268	0.0267	0.0131	0.0648	0.0632*	0.0476
Capital spending (total coefficients)							
GCC	0	0.0114	0.0050	0.0060	0.0063	0.0025	0.0073
	1	0.0468***	0.0228	0.0293*	0.0582***	0.0330*	0.0466**
	2	0.0375**	0.0185	0.0179	0.0452***	0.0250	0.0261
GCC, capital stock "H"	0			0.0068			-0.0034
	1			-0.0001			-0.0046
	2			0.0320			0.0284
Qatar	0		0.0049	-0.0210		-0.0019	-0.0244
	1		0.171***	0.183***		0.161***	0.173***
	2		0.123***	0.130***		0.120***	0.122***
Qatar, capital stock "H"	0			0.1620			0.1500
	1			0.1350			0.1460
	2			0.0638			0.0953
Global output	0	0.0141***	0.0122***	0.0123***	0.0114***	0.00997***	0.00974***
Oil prices	0	-0.0203	-0.0107	-0.0130	-0.0122	-0.0044	-0.0081
Constant		-0.0120	-0.0075	-0.0073	-0.0130	-0.0098	-0.0100
Observations		175	175	175	145	145	145
R-squared		0.291	0.383	0.399	0.365	0.439	0.459

Sources: Penn World Table and IMF staff calculations.

C. Estimating Fiscal Multiplier: A Single Country Approach (Qatar)

Estimation Strategy and Data

14. The panel analysis using data for the GCC is complemented by a single country analysis for Qatar. Similar to above, non-hydrocarbon output is regressed on central government spending (total, current, and capita), global output, and oil prices, all expressed in real growth rates. Data has greater length than before, spanning 1983–2023, which include estimates. We estimate static regressions and dynamic regressions, both vector auto-regression and local projection. In

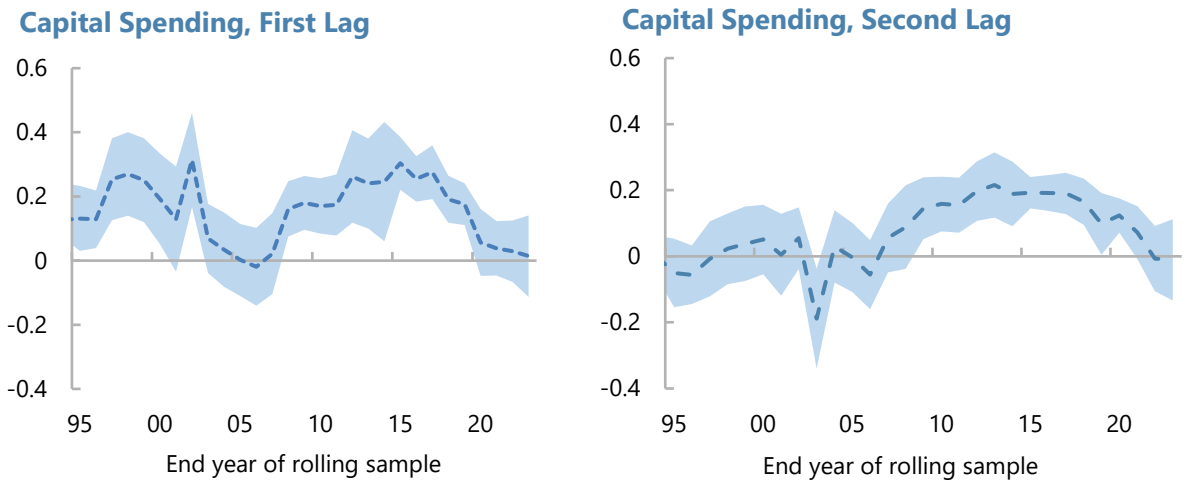
addition, time-varying growth effects of lagged capital spending are estimated using the same static model on a 12-year rolling basis.

Estimated Results

15. In the recent decade, growth effects of capital spending waned coinciding with maturing of the infrastructure investment cycle associated with the World Cup (Figure 4). Results from static and dynamic regressions confirm that growth effects of lagged capital spending are important in Qatar (Appendix I), which are further unpacked using rolling regressions. World Cup-related capital spending in the 2010s appears to have had "renewed" growth effects, particularly with greater persistence gauging from the second lag (right panel). These investments may reflect a more comprehensive infrastructure investment strategy and/or with high spending efficiency. These growth effects moderated as the infrastructure investment cycle started to mature. These interpretations are suggestive, as the model does not control for other potential determinants and the rolling approach further reduces the sample size.

Text Figure 4. Qatar: Non-hydrocarbon Growth Impact of Public Capital Spending 1/

(12-year rolling coefficient and 68 percent confidence interval)



Sources: Haver and IMF staff.
1/ Non-hydrocarbon output is regressed on current spending (L0 and L1), capital spending (L1 and L2), global output, and oil prices, all in real growth rates, on a 12-year rolling basis ending in the year indicated on the horizontal scale, using annual data for Qatar spanning 1983–2023. Coefficients on the first and second lag of capital spending are displayed.

D. Conclusions and Policy Implications

16. Results from this paper's analysis suggested that Qatar's strong capital expenditure multiplier became less impactful when the stock of capital reached a high level. This is consistent with this paper's results for a panel of GCC countries, and those from Fouejieu et al. (2018) that fiscal consolidation in the GCC may be less costly as fiscal multiplier declined over time, to the extent that the stock of capital generally rose over time.

17. The literature highlights key ingredients of productive fiscal spending relevant for Qatar. Reallocation to non-wage spending within current spending envelope, particularly to education spending that builds human capital, and higher capital spending relative to current spending tend to boost economic growth (Gupta et al., 2005; and Acosta-Ormaechea and Morozumi, 2013). However, seemingly productive expenditures, when used in excess, could become unproductive (Devarajan et al., 1996). Thus investments in new areas, particularly to support a knowledge-based economy with higher value-added sectors and to enhance climate sustainability and promote "green" growth could have significantly larger multipliers than traditional infrastructure investment (IMF, 2023b). Moreover, the growth effects of public spending tend to be more sizable, long-lasting, and stable when institutional quality is higher (Avellan et al., 2020).

18. The authorities' plan to reorient spending to support knowledge-based growth could boost growth effects of fiscal spending. Qatar already has top-notch infrastructure (and excess supply in some areas) to help elevate growth potential. Therefore, public investment should focus on improving human capital, both for nationals and expatriates, providing a more conducive environment for businesses, enhancing climate sustainability, and continuing to adapt to the energy transition. Investment in human capital (education and health) is a welcome key pillar of NDS3 and there is scope to improve spending efficiency in Qatar. Further investment in climate adaptation would mitigate its vulnerabilities to climate stressors. More investment to facilitate decarbonization and promote renewables would help Qatar reach its emission reduction target and smooth the energy transition process. Crowding in private sector investment with efficient public spending would further economic diversification and accelerate the transition to private sector-driven growth.

Annex I. Additional Results

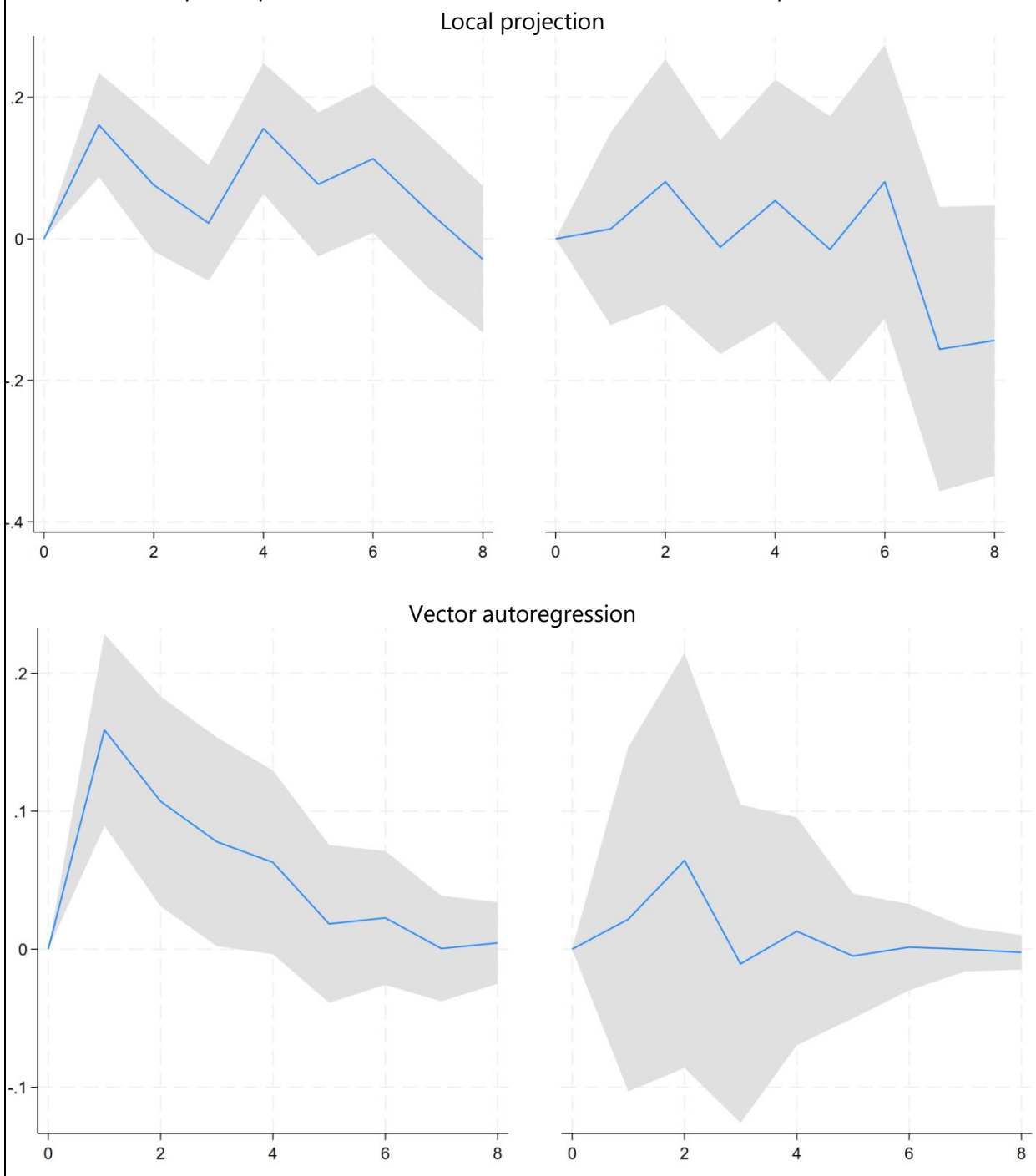
Annex I. Table 1. Qatar: Determinants of Non-Hydrocarbon Output 1/

Model		1	2	3	4
	Lag				
Total spending	0	0.129	..	..	..
	1	0.236***	..	..	..
	2	0.228***	..	..	..
Current spending	0	..	0.212**	..	0.099
	1	..	0.115	..	0.030
	2	..	0.180**	..	0.088
Capital spending	0	..	..	0.011	0.007
	1	..	..	0.180***	0.155***
	2	..	..	0.128***	0.102**
Global output	0	1.198	1.404	1.973**	1.790**
Oil prices	0	-0.068	-0.072	-0.068	-0.082*
Constant	0	-0.356	-0.627	-2.383	-2.393
N		39	39	39	39
R^2		0.493	0.374	0.593	0.638

* p<.1; ** p<.05; *** p<.01

Sources: Haver, IMF WEO, and IMF staff calculations.
1/ OLS results. The dependent variable is real growth of non-hydrocarbon output. The independent variables are all in real growth rates.

Annex I. Figure 1. Qatar: Impact of Fiscal Expenditure on Non-hydrocarbon Output 1/



Sources: Haver, IMF WEO, and IMF staff calculations.
1/ Endogenous variables are current expenditure, capital expenditure, and non-hydrocarbon output (all in real growth rates) in this order. Exogenous variables are global output and oil prices (both in real growth rates). IRFs show the impact of the mentioned variables on non-hydrocarbon output.

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BUILDING A KNOWLEDGE-BASED ECONOMY TO BOOST GROWTH: THE ROLE OF EXPORT DIVERSIFICATION[1]

Motivated by Qatar's Third National Development Strategy, this note discusses ingredients for boosting export diversification and growth potential. Drawing on cross-country experiences and empirical analyses, we shed light on how successful policies supported building human capital and economic complexity, the type of strategy that could best suite Qatar's circumstances, and pitfalls to avoid.

A. Introduction

1. The Third National Development Strategy (NDS3) lays out plans to build a knowledge-based economy to boost growth potential, focusing on the role of export diversification. Export diversification is an important pillar of broader economic diversification given the small size of domestic markets in Qatar. However, compared to the progress made in diversifying output and fiscal revenue, export diversification has been more limited. Declining productivity and other impediments have held back the pace of export diversification.[2] Against this backdrop, NDS3 stresses the importance of building a knowledge-based economy by strengthening the business environment, labor markets, fiscal and institutional frameworks to close important gaps in innovation, human capital, and the regulatory environment. It also identifies "diversification clusters" to build comparative advantages, setting ambitious targets both at the sectoral level and on macroeconomic outcomes (Figure 1).[3] NDS3 focuses on harmonizing economic zone to help attract FDI, boosting international trade including thought additional agreements with key target markets, and Public-Private partnership (PPP) to facilitate private sector participation.

2. Motivated by NDS3, this paper discussed options for Qatar to build a knowledge-based economy with a focus on boosting export diversification in complex products. Section B reviews Qatar's progress in export diversification and sketches the role of product and economic complexity in lifting export diversification and output. Section C econometrically establishes the role of economic complexity, and human and physical capital for boosting export diversification and non-hydrocarbon output. Section D discusses cross-country

[1] Prepared by Ken Miyajima. The author would like to thank the participants of the 2024 Staff Visit Workshop at the Ministry of Finance, and the IMF's Chile, Korea, and Malaysia county teams for their very helpful suggestions and comments.

[2] The growth rate of total factor productivity over the past 4 decades were negative in Qatar, similar to its peer GCC countries. Other impediments include barriers to market entry and FDI, various regulatory impediments, an immature innovation ecosystem, and insufficient human capital.

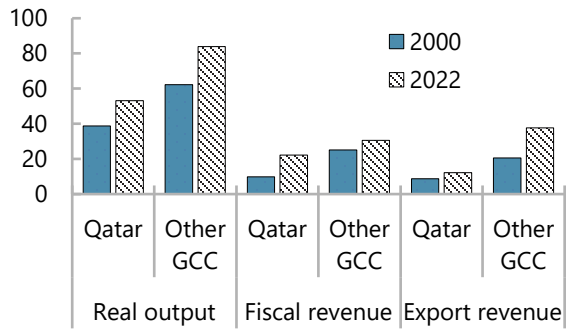
[3] Selected priority sectors include manufacturing (petrochemicals, plastic products, and low-carbon metals), ICT, and education.

experience of strategies to diversify exports. Following the literature we focus on three economies (Korea, Malaysia, and Chile) that have followed different diversification strategies. Korea is a frontier country in this analysis, and its case helps us analyze how its diversification strategy to jump into high value-added sectors could achieve very strong growth performance. Malaysia and Chile's cases represent distinctively different growth strategies. These two countries also share characteristics with Qatar—both of them export commodities and Malaysia relies on expatriate workers even though less than Qatar does. Section E takes a closer look at Korea's case. Section F draws lessons for Qatar, while Section G discusses policy priorities. Section H concludes.

Text Figure 1. Qatar: Indicators of Economic Diversification, Human Capital, and Productivity

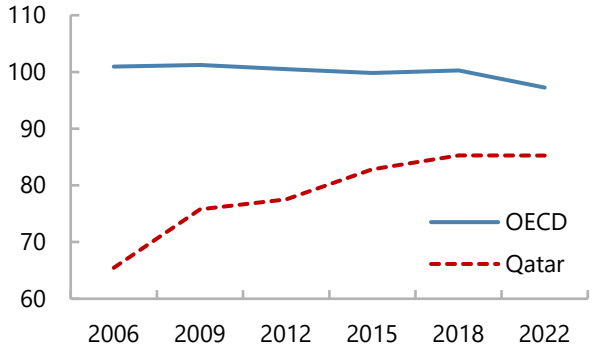
Qatar has made progress in economic diversification...

Economic Diversification
(Percent, non-hydrocarbon sector's share of total)



...and in boosting educational attainment...

PISA Test Scores
(OECD period average = 100)

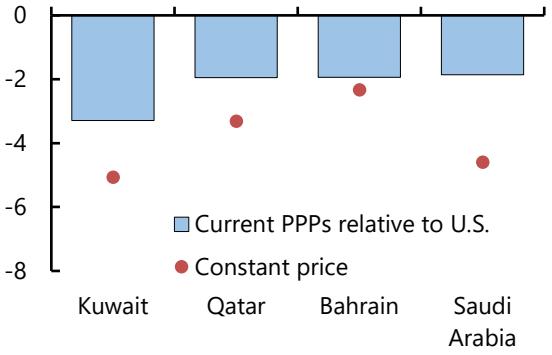


...with room to attract and retain more higher-skilled expatiate workers...

Expatriate Workers in Qatar by Skill
(Percent of total, 2006, 2013, 2020)

...and improve productivity.

Productivity Improvements
(Percent, average annual growth rate of TFP, 1974-2019)



Sources: Haver, IMF WEO, OECD, Qatar Economic Outlook 2020-23 (PSA), and IMF staff calculations.

B. Qatar's Progress in Export Diversification

3. Qatar has made progress in diversifying services exports but less so in goods exports. During the last two decades, the share of services exports increased notably, including transport, tourism, and ICT (Figure 2, upper panels). In particular, ICT could generate high value added and sustained productivity gains. The "*product space*", which visualizes the structure of goods exports with a particular focus on the *distance* between products of different levels of complexity, has remained broadly unchanged (middle panels).[4] Notably, Qatar's main export product minerals are relatively isolated from other products (mostly shown as empty dots, which are not produced by Qatar), and especially from products with higher complexity that are located to the left of the product space. Qatar's global shares of relatively complex products (electronics and machinery) are low compared to GCC peers and other selected economics that are discussed in detail later (lower panels).

4. Producing goods with higher complexity is important for boosting export diversification and non-hydrocarbon output. The literature highlights that countries with greater economic complexity, or a more diverse and sophisticated production structure requiring advanced knowledge and technology, tend to experience greater economic growth than those with simpler economies focused on basic goods (Balland et al., 2022; Hassanein et al, 2024).[5] Producing and exporting goods with greater complexity creates learning and make investment and labor more productive. High levels of economic growth might in turn facilitate the development of a more complex economy through increased investment in research and development, creating a virtuous cycle (Stojkoski and Kocarev, 2017; You et al., 2022). Qatar and other GCC counties are in the middle of the pack as for economic complexity (Figure 3). Given their economic complexity, technology-intensive manufacturing exports are relatively low while per-capita income is relatively high.[6] Section C further explores how economic complexity is associated with per-capita real GDP growth.

[4] The distance represents relatedness to existing know-how, capabilities, and inputs in order to enter production. Every two products have a globally defined proximity between them as measured by the probability of co-export, that if a country exports product A, what is the probability they also export product B.

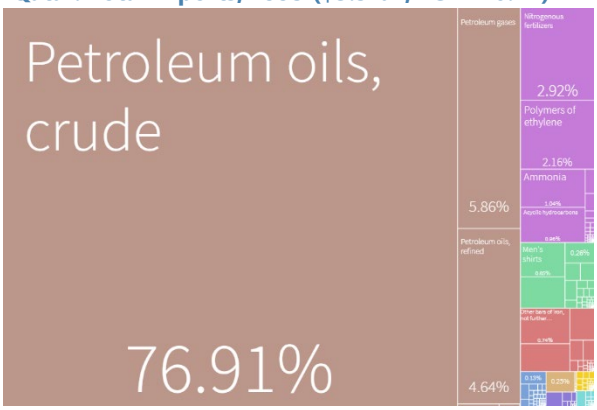
[5] The economic complexity index is calculated from equations for diversity and ubiquity to express the recursion (Hidalgo and Hausmann, 2009).

[6] The key message remains unchanged when total GDP is used.

Text Figure 2. Qatar: Export Diversification in Qatar and Selected Economies

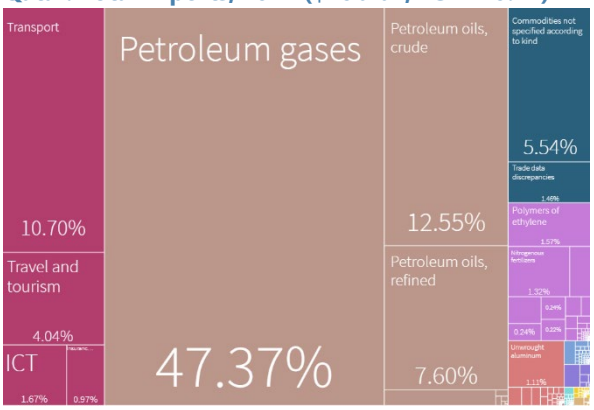
Qatar's total export diversification from 1995...

Qatar: Total Exports, 1995 ($3.5 bn, ECI = -0.72)



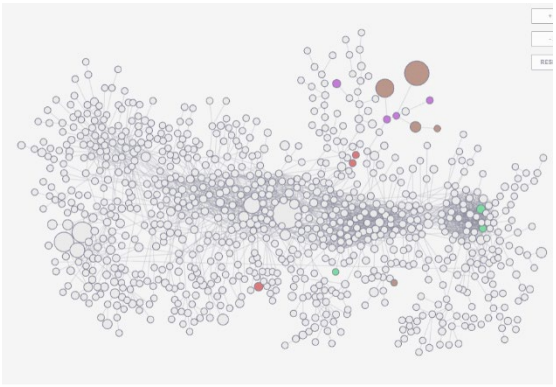
...to 2021 progressed due to services (red area below)...

Qatar: Total Exports, 2021 ($10b bn, ECI = -0.41)



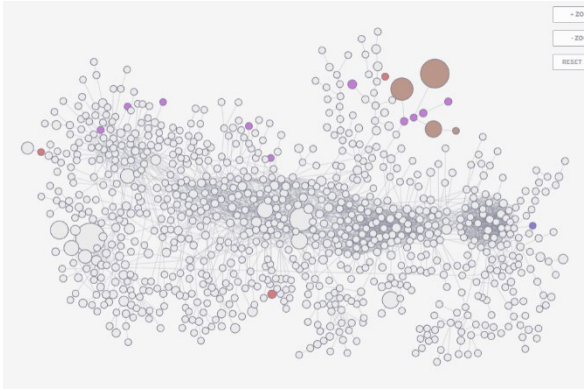
...while goods exports have largely been unchanged...

Qatar: Goods Exports, 1995



...mainly minerals (in brown) and chamicals (in purple).

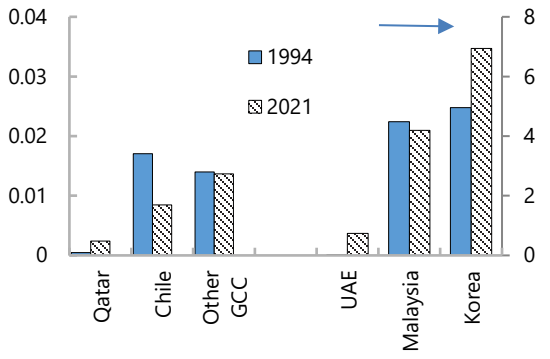
Qatar: Goods Exports, 2021



Qatar's exports of high value-added and complex products including electronics...

Electronics Exports 1/

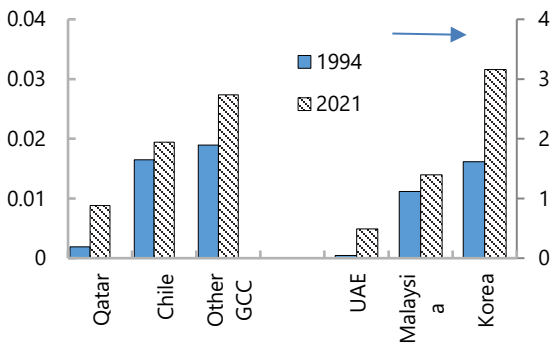
(Percent of global exports)



...and machinery have been relatively low.

Machinery Exports 1/

(Percent of global exports)

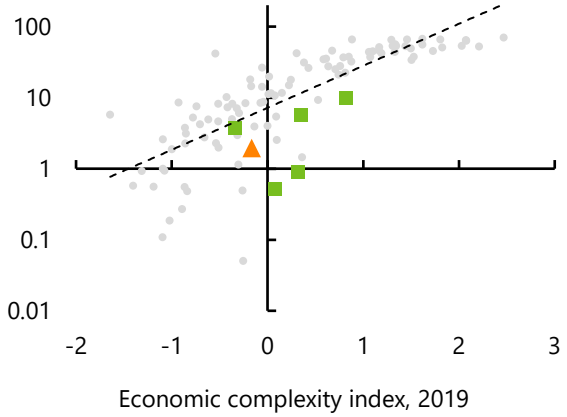


Sources: Atlas of Economic Complexity and IMF staff.
1/ Other GCC = Bahrain, Kuwait, Oman, Saudi Arabia. The UAE is on the right scale, with Malaysia and Korea.

Text Figure 3. Qatar: Economic Complexity and Macroeconomic Performance

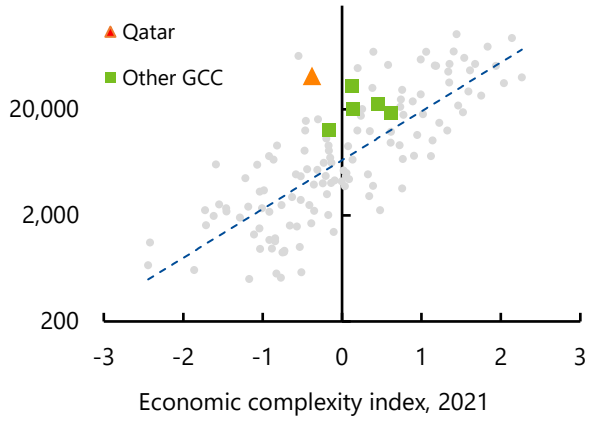
Higher economic complexity is assocaited with greater export diversification to high-tech. manufacturing…

Medium and High Tech. Manufacturing Exports
(In percent of total goods exports, 2019, log scale)



…and with greater per-capita non-hydrocarbon output.

Per-Capita Non-Hydrocarbon Output
(In US dollars, 2021, log scale)



Sources: Penn World Table and IMF staff calculations.

C. Determinants of Export Diversification and Economic Growth

5. The role of economic complexity in boosting export diversification and per-capita income is econometrically explored. The dependent variables are medium and high-tech exports in percent of total goods exports, and per-capita real income, both in logarithm similar to in Figure 3. The explanatory variables are indicators of economic complexity, human capital, physical capital, and employment-to-population ratio. Additionally, interaction terms between economic complexity and human capital or physical capital are included to explain per-capita real income. Annual data spanning 1960–2019 are used for export regressions, while non-overlapping 5-year averages are used for per-capita real income regressions to capture long-term effects as standard in the literature employing growth regressions (that is, 1960-64, 1965-1969, …, 2010-19). Both data are collected for the same panel of 133 countries. Pooled, fixed-effects panel, and random-effects panel models are estimated to check robustness. Estimated coefficients from the pooled models, broadly corresponding to the trend line in Figure 3, and those from fixed-effects and random-effects models are reported in Annex Tables 1 and 2. Random-effects results are comparable to fixed-effects results. Hausman test results suggest fixed-effects models are preferred.

6. Results highlight that economic complexity is positively associated with medium- and high-tech exports. Results from pooled, fixed-effects, and random-effects regressions summarized in Annex Table A1 suggest higher economic complexity promotes export diversification into medium and high-tech. manufacturing exports. Equally notable is the importance of human capital in supporting export diversification (while physical capital does not come out as an important factor). Applying statistically significant coefficients from model 6, if Qatar's economic complexity improves by one unit, which equals to one standard deviation in the sample, the nation's medium to high-tech manufacturing exports would increase by 8–9 percentage points of total goods exports

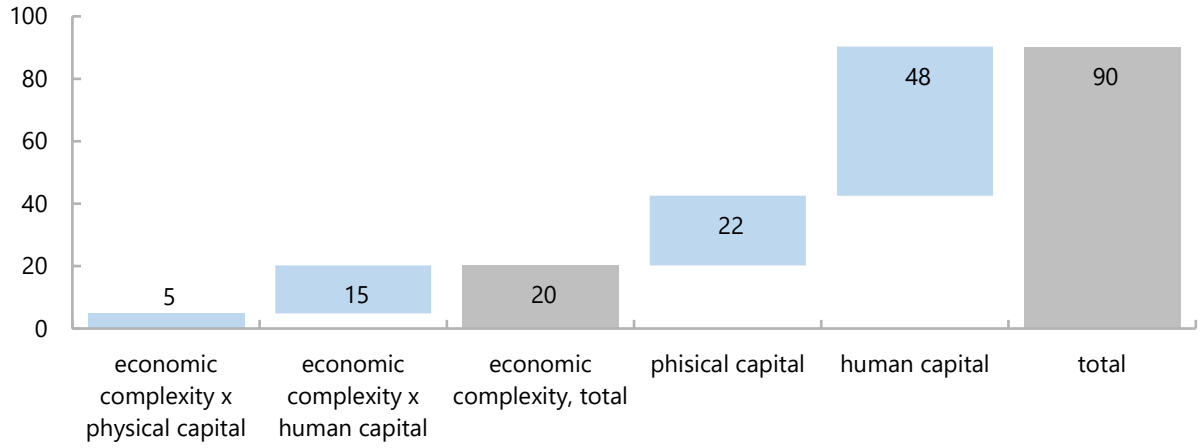
(from around 2 percent in 2019). Increasing economic complexity to the level of Malaysia's, one of the successful country cases discussed later, would imply a more significant increase, by 12–13 percentage points, in Qatar's export share.

Text Figure 4. Qatar: Impact of Economic Complexity and Human & Physical Capital on Per-Capita Output

(Percent)

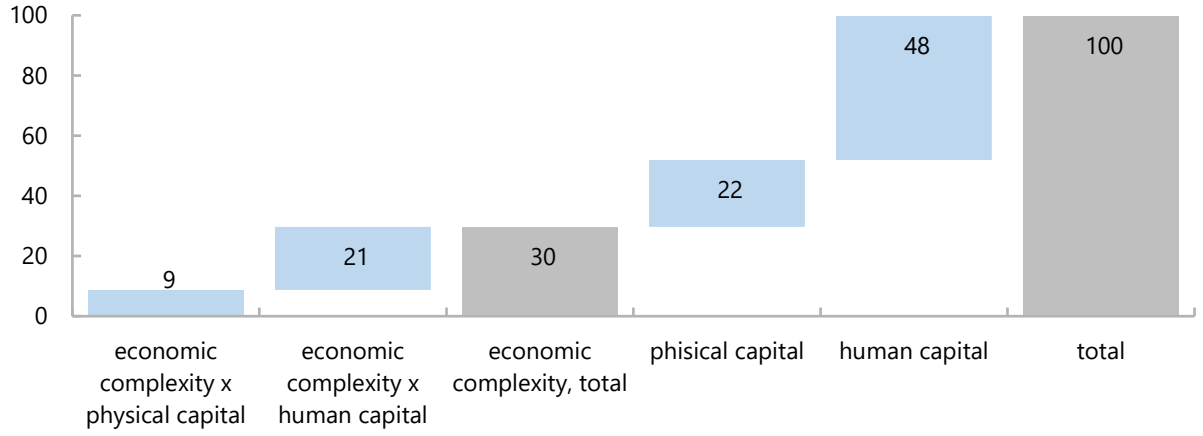
Economic complexity, and human & physical capital are key determnants of per-capital output…

When Human and Physical Capital = Mean



…and higher economic complexity boosts the gorwth imapct of human & physical capital.

When Human and Physical Capital = Mean + One Standard Deviation



Source: IMF staff calculations.

7. Results also show how the association of economic complexity with per-capita real income is amplified by the physical and human capital. Based on regressions results summarized in Table A2, illustrative scenarios using a hypothetical average economy is shown in Figure 4. The upper panel shows the impact of one standard deviation increase in human capital, physical capital, and economic complexity index on per-capita real output. First, human capital is very important, making the largest contributor to per-capita real output. Second, physical capital is also important,

even though its contribution to per-capita real output is smaller. Given the simulation is for an average country, and Qatar's physical capital is already large in volume and of high quality, the marginal impact of a rise in physical capital would be smaller for Qatar. Third, the impact of an increase in economic complexity on per-capita real output is stronger when the starting levels of human and physical capital are higher. In other words, for a given level of technology, its growth impact is larger when the population is more skilled and when infrastructure is of higher quality. Numerically, the impact of a one standard deviation increase in economic complexity is 20 percentage points when human and physical capital are at the average levels across country and time. The growth impact of economic complexity increases to 30 percentage points when the starting levels of human and physical capital are above the average by one standard deviation (Figure 4, lower panel).

D. Technology and Innovation Policies to Boost Economic Complexity: Selected Country Cases

8. Technology and Innovation Policy can help boost economic complexity and eventually per-capita income durably. Qatar already has a high level of top-notch capital stock, and a clear strategy to boost human capital. To complement, we focus on policies that can boost economic complexity, or Technology and Innovation Policy (TIP). The thrust of TIP echoes the strategic priorities of NDS3, that is, to support domestic sophisticated industries, sometimes beyond comparative advantage with export orientation, especially when domestic markets are small like in Qatar. Fierce competition with strict accountability supports productivity gains.

9. In this context, we draw lessons from more successful country cases in improving economic complexity. These examples are intended to serve at least two purposes. First, they help shed light on the type of strategy that suites Qatar's circumstances the best. Drawing on Cherif et al. (2024) and other papers by the authors, in what follows we focus on Chile, Korea, and Malaysia, which relied on different strategies to boost economic and export complexity and achieved different degrees of success (Figure 5). The strategies pursued by Korea, Malaysia, and Chile are sometimes characterized as "Moonshots", "Leapfrog", and "Snail crawl", where Moonshots delivered the greatest growth gains. Two of them also export commodities, and in one of them expatriate workers play an important role, making these countries' experiences and lessons particularly relevant for Qatar. We use country experiences and tools from the Atlas of Economic Complexity to illustrate different strategies. Second, country examples provide lessons as to how successful policies including TIP supported boosting human capital and economic complexity, and pitfalls to avoid for commodity exporters to diversify.

- **Korea**. Earlier the nation's comparative advantage was in low tech sectors. Yet, the nation managed to lift its real per-capital income from less than 10 percent of the US to nearly 70 percent of the US. It registered 8 percent average growth over and above the US over the period. This experience is sometimes baptized as "Moonshots". During the transformation Korea became more tech intensive and increased its economic complexity. How did it do?

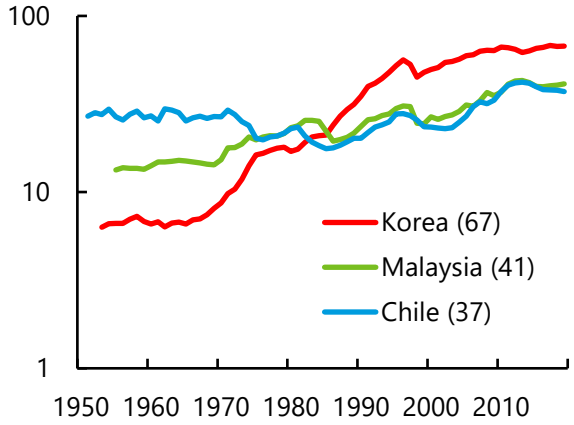
- **Malaysia**. It still exports hydrocarbon, but also managed to create higher value-added exports and growth. Its economic complexity did not rise as much as Korea's. Its average annual growth rate was 6 percent over the US, which was strong, but not as strong as Korea's. This case is called as "leapfrog". So, what did Malaysia do well to grow that fast? What did Malaysia do less well?

- **Chile**. Its main exports currently include copper, and agricultural products. Its economic complexity stagnated. Its average annual growth rate was 4.5 percent over the US. Why is that Chile's growth did not take off as much?

Text Figure 5. Selected Country Cases of Economic Growth

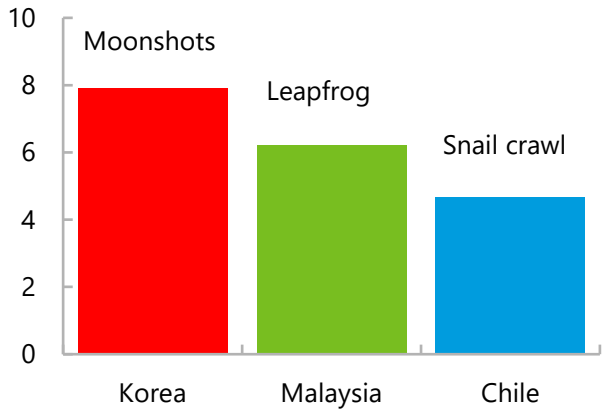
Korea, Malaysia, and Chile have delivered strong economic growth over the past decades...

Per-Capita Real GDP over U.S.[1/]
(Percent of U.S. in log, 2017 PPP US$)



... with annual average per-capital growth rates being 4–8 above that of the U.S.

Per-Capita Real GDP Growth over U.S.
(Percent, year on year, average over 1965-2019)



Sources: Penn World Table and IMF staff calculations.
1/ 2019 values in parentheses.

10. In the following sections, we take a closer look at Korea' case, draw key lessons for Qatar also from experiences of Malaysia and Chile, and discuss policy priorities. Korea's case (Section E) provides a strong narrative as to how reaching for complex products beyond comparative advantage supported by the right policies (Section F) could boost economic complexity and growth potential to the extent that not many had expected ex-ante. This and experiences of Malaysia and Chile provide important insights for policy priorities for Qatar (Section G) whose export diversification opportunities are relatively "distant", even when compared with Malaysia, which relies on expatriate workers and exports commodities and has greater similarity than Korea with Qatar.

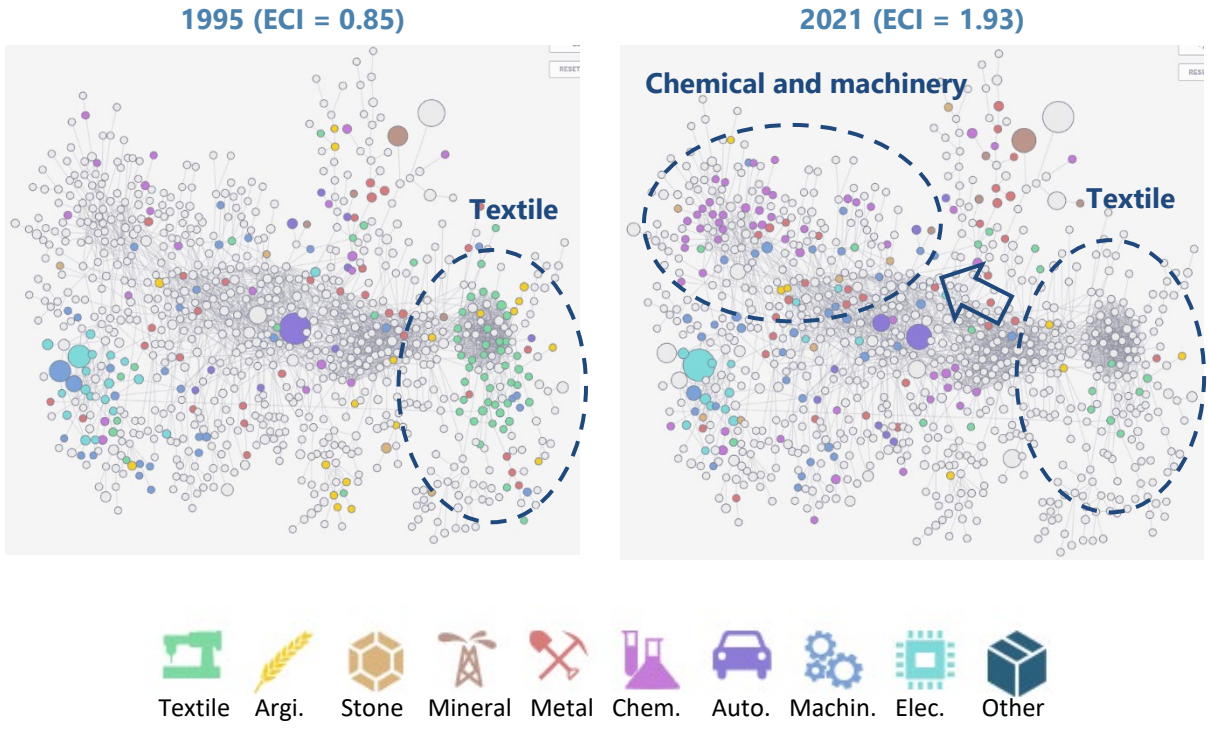
E. Closer Look at Korea's Goods Export Diversification

11. Korea journey of export diversification into more complex products is analyzed relying on the Atlas of Economic Complexity. The "*product space*" shows how Korea's export mix evolved over time, and the "*feasible opportunities*" helps analyze the direction of export diversification. The data go back to 1995 and excludes the earlier period of acceleration in per-capita income growth.

Text Figure 6. Increasing Complexity of Korea's Product Space [1/]

Korea's export mix shifted away, for instnace, from textile (lower complexity)...

...to chamical and machinery (higher complexity).



Sources: Atlas of Economic Complexity and IMF staff.

1/ Goods exports. ECI = economic complexity index. Total goods trade rose from $150 billion in 1995 to $803 billion in 2021.

12. Korea's product space became more complex from 1995 to 2021 (Figure 6).

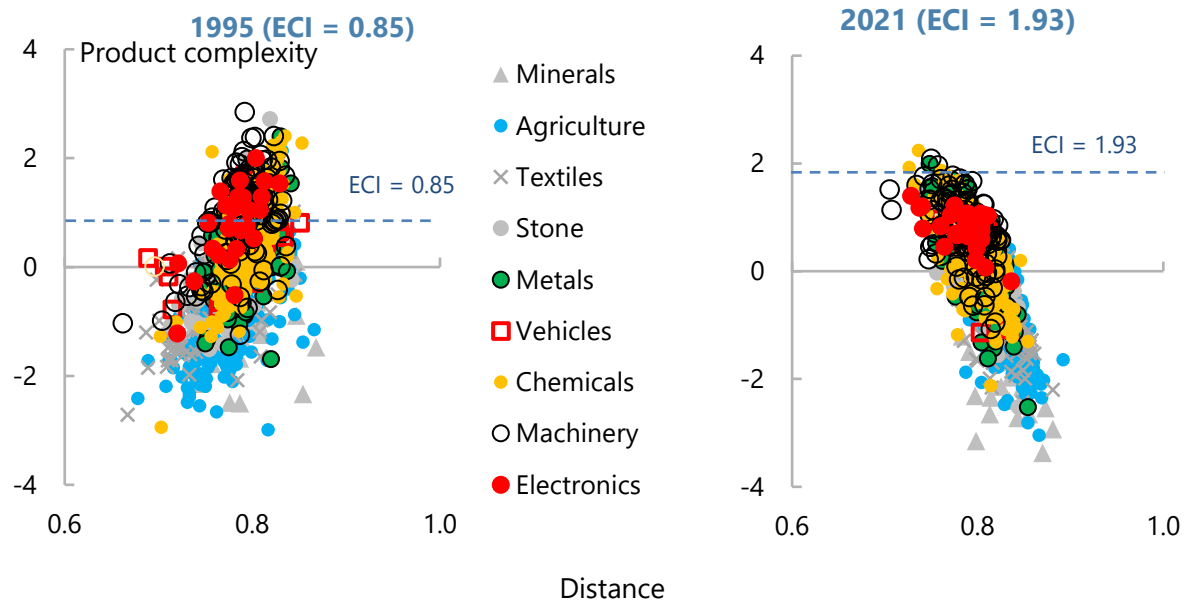
- **In Figure 6, the little circles represent several hundreds of key export products by all countries.** The circles are colored when Korea exported the goods. The size of each circle represents the relative amount traded globally and therefore change from 1995 to 2021. The distance between two circles represents similarity in production capabilities—circles next to each other share similar capabilities to produce them, therefore easier to diversify into. The distance, or ease of diversification, is measured by the probability of a country producing two particular products based on actual trade data over decades across all countries.

- **Korea's export mix was focused more on products with lower complexity**, such as textile and agriculture on the right, in 1995. By 2021, the nation's export mix moved away into products with higher complexity, such as electronics and machinery on the left. At the same time, Korea's economic complexity more than doubled from 0.9 in 1995 to 1.9 in 2021. On would conjecture that back in 1995 Korea could diversify into lower complexity products more easily, while in 2021, diversifying into more complex products become easier.

Text Figure 7. Korea's Goods Exports Diversification Opportunities [1/]

For Korea, export diversification to products with lower compelxity was "easier" in 1995...

...while diversification to products with higher complexity became "easier" in 2021.



Sources: Atlas of Economic Complexity and IMF staff.

1/ ECI = economic complexity index. Total goods trade rose from $150 billion in 1995 to $803 billion in 2021.

13. Korea's feasible opportunities suggest that the country's capabilities to diversify into more complex goods have increased over time (Figure 7). This puts Korea in a favorable position where it is easier to expand into higher value-added products.

- **In the figure, the horizontal axis shows the distance, measuring ease of diversification.** Empirically the minimum value is around 0.4-0.5 (e.g., for Germany) and the shortest distance of around 0.7 for Korea is relatively short. The vertical axis represents each product's complexity—product complexity rises from textile and agriculture to electronics and machinery.

- **In 1995, when Korea's economic complexity was still not as high, low complexity products (textile, agriculture) were easier to diversify into and less distant, more complex products (electrical, machinery) were less easy to diversify into and more distant.** Thus, the feasible opportunity was tilted to the right. Fast forward to 2021, as Korea's economic complexity rose (the broken horizontal line moved up), more complex products because less distant than less complex products. The dots were tilted to the left. The existing product mix, thus know-how and production capabilities were more conducive to diversify into electronics and machinery.

F. Key Lessons for Qatar

14. Cross-country experiences highlight the importance of human capital and high value-added manufacturing exports, while leveraging existing comparative advantage.

- **Human capital.** Korea invested in human capital development through general, vocational education, and health care. Malaysia crated the Human Resources Development Fund and programs to study abroad which were extensively used. Given the importance of foreign workers, albeit at a smaller scale than in Qatar, Malaysia put in place policies to attract and retain skilled workers. For instance, a government agency (TalentCorp) implemented programs including a 10-year renewable visa for highly skilled expatriate workers.

- **TIP/economic zones.** In Korea, strict accountability was required for receiving government support. Intense competition domestically and abroad amid pressure to export created conditions for extensive productivity improvements. Local technology creation helped build comparative advantages (over several decades). Malaysia put strong emphasis on technology transfers, upgrades, and international competition. Multinational corporations (MNC) supported export sophistication, but some believe that technology diffusion was not extensive in Malaysia partly as MNC were "not keen" on sharing technology with local partners. Also, linkages of FDI and free trade zones with the broader onshore economy were not very strong (Cherif and Hasanov, 2015). Malaysia was less successful in developing comparative advantage in high value-added goods.

- **Services.** Some services exports can bolster the non-hydrocarbon economy but would not generate sustained productivity and therefore growth gains (e.g., tourism). Others can play a more significant role in the longer run, including to support high value-added manufacturing exports (e.g., logistics, transportation). Highly productive services, such as modern tradable services (telecommunications, logistics and delivery, and financial services) reduce transaction costs, provide infrastructure for digital transactions, and elevate growth potential, especially when supported by competition-enhancing policies (IMF, 2024b). Chile's diversification strategy focusing mainly on agriculture worked as intended but the long-term growth dividends are more limited.[7] In Qatar, where visitor arrivals have risen structurally, tourism can leverage existing high-quality infrastructure and make the country more attractive to high-skilled expatriate workers but does not obviate the need to diversify into more complex manufacturing and service exports to durably lift growth potential. The existing logistics infrastructure would support manufacturing exports.

G. Policy Priorities for Qatar

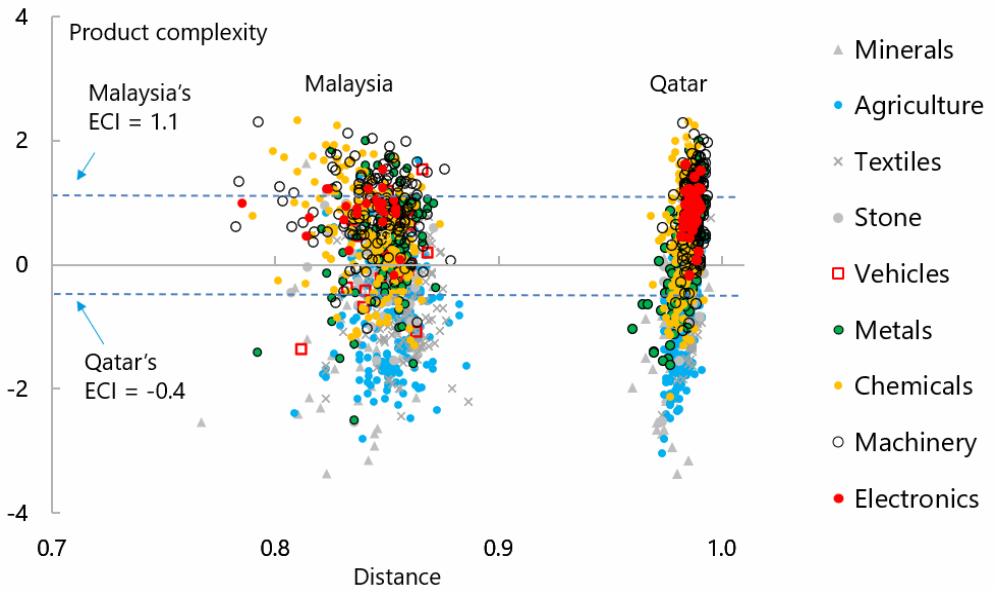
15. To diversify goods exports, Qatar could consider products with higher complexity (Figure 8). Malaysia's feasible opportunities plotted for comparison are less distant than Qatar's from own export mix, and somewhat tilted to the left, that is, diversifying into products with higher complexity is in some cases easier than those with lower complexity. By contrast, the opportunities to diversify goods exports for Qatar are relatively distant, close to 1 (the maximum in the framework). NDS3 focuses on downstream products from hydrocarbon, such as petrochemical (a "Snail crawl" or at most "Leapfrog" type of strategy). However, given most products are similarly

[7] Lebdioui (2019) discusses how this comparative advantage in agriculture was the outcome of proactive export diversification policy rather than free-market policy.

distanced, suggesting that efforts required are similarly significant, reaching for products with higher complexity (akin to "Moonshots") would generate greater productivity and growth gains. In doing so one important consideration is complementarity—given Qatar's comparative advantage in logistics and connectivity through seaports and airports, sectors that can leverage them could deliver greater gains. Regionally, diversifying into sectors that are somewhat different from, or those that complement those targeted by other GCC countries could generate greater gains.

Text Figure 8. Malaysia and Qatar: Feasible Goods Export Opportunities, 2021 [1/]

For Qatar, export diversification to any goods would require extensive efforts.



Sources: Atlas of Economic Complexity and IMF staff.

1/ ECI = economic complexity index.

16. Export diversification to complex products would call for intensifying reforms in key areas. It would involve fostering human capital, FDI, and competitive environment (Figure 9).

- **Human capital.** Qatar has made progress in enhancing education attainment but has further room to enhance human capital especially when compared with the high level of top-notch physical capital. Korea and Malaysia's prominent success hinged on strong fucus on human capital building, and their more aggressive diversification strategies that allowed to leverage high level of human capital. Given expatriate workers represent the large share of total labor in Qatar, measures to attract and retained skilled expatriate workers should be intensified, similar to Malaysia' case.

- **FDI**. In Qatar, FDI in non-hydrocarbon economy is low overall even though inflows in high value-added sectors, such as Chemicals and ICT, are rising. Intensifying effort to boost financial depth, human capital, institution, and labor market flexibility would continue to attract FDI (Yu and Walsh, 2010). In addition, Qatar has put strong emphasis on public-private partnership (PPP) to attract FDI—PPP needs to be mindful of fiscal risk. To leverage the impact of FDI, maximizing

domestic spillovers is key, as we saw in Malaysia's case. Building local technology, even though over several decades, contributed Korea's success (also see UNCTAD, 2003; Javorcik et al., 2018). To this end, Qatar's patent application started to increase rapidly and a boost to R&D spending could continue the strong trend.

- **Competitive environment.** Qatar's manufacturing exports are relatively low and may be below potential, leaving a significant upside to grow. Reducing the state's footprint, further upgrading regulatory environment, and ensuring level playing field would facilitate private investment and help Qatar boost production of more complex products. Intense competition domestically and abroad amid pressure to export underpinned Korea success in export diversification to complex products. Meanwhile, Qatar's conditions for trade are favorable, with many trade and other agreements, and generally low trade barriers. Further fostering trade diversification would involve reducing remaining tariff and non-tariff barriers, exploring new trade corridors (Middle Corridor from China to Europe; India-Middle East-Europe Corridor), and investments in the digital economy.

17. Horizontal policies discussed above could be complemented by vertical policies, as appropriate. Vertical policies target specific sectors or industries. Such policies may be justified in the presence of well-identified externalities, coordination failures or under-provision of public input. Using such policies should be mindful of several DOs and DO NOTs (IMF, 2024a):

- **DOs**. Vertical polices should be targeted, time-bound, cost-effective, transparent, and deliver on objectives. Social goals should be clearly identified (e.g., emission reductions). Domestic knowledge spillovers from innovation in targeted sectors should be strong. Sufficient administrative capacity should be in place. Proper cost-benefit analysis and impact evaluation, together with strict exit criteria, claw-back mechanisms, and sunset clauses, would help minimize risks and phase out policies as needed. Importantly, such targeted interventions should not be a substitute for broad-based structural reforms, which should continue to be rolled out.

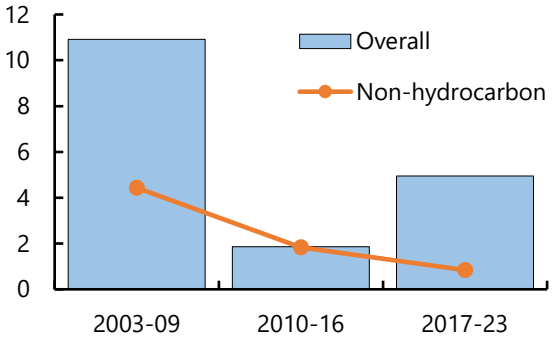
- **DO NOTs**. Vertical policies should avoid creating negative effects on macroeconomic, fiscal, and external sustainability. They should not generate negative cross-border spillovers, including harming trading partners, or violating international commitments.

Text Figure 9. Qatar: Catalysts of Export Diversification and Growth 1/

Annual FDI commitments to non-hydrocarbon sectors represent small shares of total…

Annual FDI Commitments by Sector

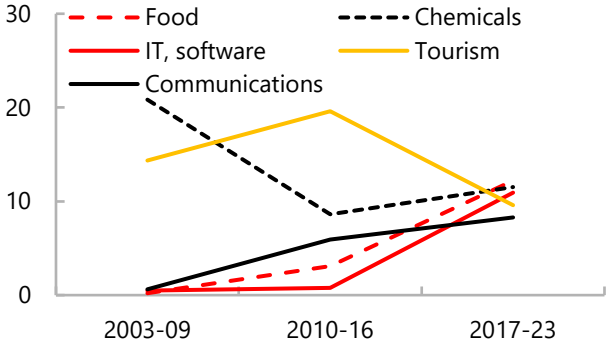
(US$ billions, period average)



…but sectors with higher complexity are gaining in importance as a share of total non-hydrocarbon.

Annual FDI Commitments by Industry

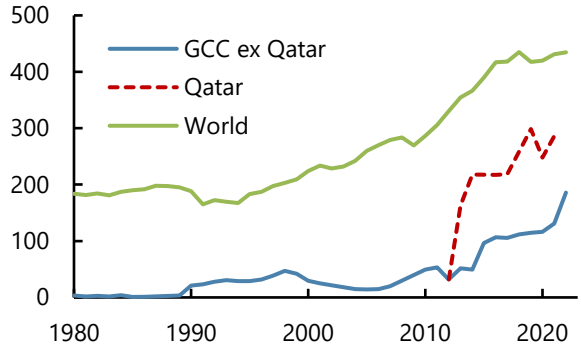
(Period average, percent of total non-hydrocarbon)



Qatar's patent applications jumped in the last decade…

Total Patent Applications

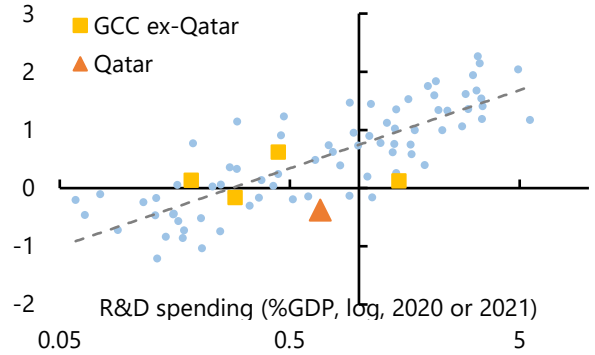
(Per one million population)



…which can continue rising as Qatar is set to boost R&D spending.

R&D Spending and Economic Complexity

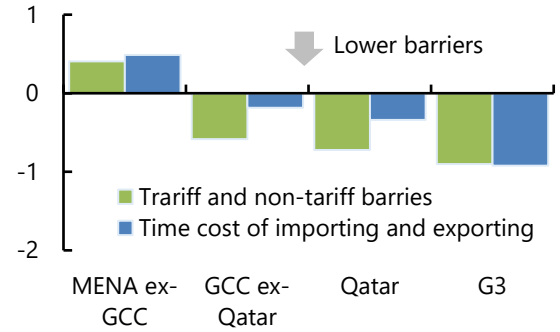
(Economic complexity index, 2021)



Trade barriers are relatively low in Qatar…

Indicators of Trade Barriers, 2021

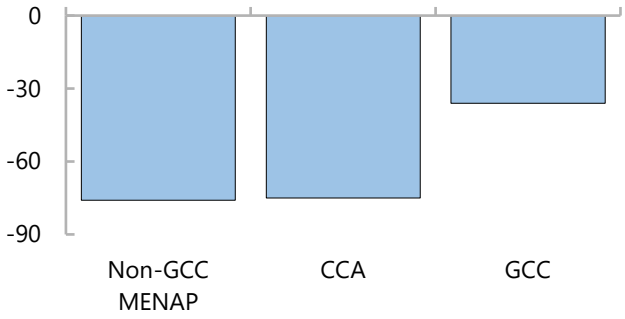
(Deviation from 165 country-mean in standard deviation)



…while IMF's internal analysis suggests room to boost manufacturing exports for the GCC, potentially for Qatar.

Estimated Manufacturing Export Gaps

(Percent of potential)



Sources: FDI intelligence and IMF staff. The World Intellectual Property Organization, WDI, Fraser Institute Economic Freedom of the World, and IMF staff. The World Intellectual Property Organization, WDI.

1/ Non-hydrocarbon excludes "coal, oil, and gas."

H. Concluding Remarks

18. Empirical analysis and experience from other countries provides lessons Qatar could consider in implementing NDS3. Growth potential could be boosted by building a knowledge-based economy with a focus on enhancing export diversification into higher technology manufacturing products. To achieve this, Qatar could go beyond sectors where it already has comparative advantages by focusing more on developing sectors with high complexity. A strong focus on attracting and developing human capital, technology, private sector investment into high value-added non-hydrocarbon activities, and competitive environment are the key ingredients for a success. The role of services needs to be carefully assessed to leverage them the most to support high value-added manufacturing exports and long-term growth potential. Benefits from vertical policies to complement horizontal policies need to be carefully weighed against a range of pitfalls.

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Annex I. Table 1. Qatar: Determinants of Mid and High-tech Exports 1/

	Pooled	Fixed effects					Random effects				
Model #	1	2	3	4	5	6	5	6	7	8	9
Economic complexity index	1.374***	0.840***	0.723***	0.869***	0.807***	0.764***	1.017***	0.918***	1.010***	1.028***	0.946***
Physical capital	...	...	0.091	...	...	-0.128	...	0.085	...	...	-0.05
Human capital	...	...	...	0.323***	...	0.320**	...	...	0.259***	...	0.289***
Employment to population	...	...	...	...	1.758***	0.549	...	...	...	0.599	-0.405
Constant	1.880***	2.011***	2.042***	1.132***	1.281***	1.080***	1.960***	1.969***	1.261***	1.705***	1.436***
Number of observations	2,080	2,080	1,880	1,960	2,080	1,760	2,080	1,880	1,960	2,080	1,760
R-squared	0.622	0.088	0.077	0.100	0.094	0.086	...	...	...	...	...

Source: Atlas of Economic Complexity, Economic Diversification Index (EDI), Observatory of Economic Complexity (OEC), Penn World Table 10 (PWT10), and IMF staff.

1/ *, **, and *** signify statistical significance at the 15, 5, and 1 percent levels. Dependent variable is mid and high-tech exports as a share of total goods exports in logarithm, from EDI. Economic complexity index from OEC up to 1995 and the Atlas from 1995 and rebased as needed to chain the data from the two sources. PWT10 data for capital stock (constant 2017 national prices, in US$, variable name rkna), human capital (index of years of schooling and returns to education, variable name hc), real output, population, and employment. Annual data spanning 1960–2019 for a panel of 133 countries. Hausmann tests reject random effects.

Annex I. Table 2. Qatar: Determinants of Per-capita Real Income 1/

	Pooled	Fixed effects			Random effects		
Model #	1	2	3	4	5	6	7
Economic complexity index	0.714***	0.134***	0.098***	-0.103	0.328***	0.141***	-0.069
Physical capital	...	...	0.710***	0.671***	...	0.618***	0.587***
Human capital	...	...	0.574***	0.558***	...	0.630***	0.609***
Employment to population	...	...	0.893***	0.936***	...	1.015***	1.030***
Interaction terms							
Economic complexity x physical capital	...	...	...	0.119**	...	...	0.122**
Economic complexity x human capital	...	...	...	0.068*	...	...	0.069*
Constant	8.861***	8.896***	7.080***	7.080***	8.897***	6.896***	6.916***
Number of observations	1,316	1,316	1,037	1,037	1,316	1,037	1,037
R-squared	0.362	0.006	0.673	0.685	...	...	...

Source: Atlas of Economic Complexity, Observatory of Economic Complexity (OEC), Penn World Table 10 (PWT10), and IMF staff.
1/ *, **, and *** signify statistical significance at the 15, 5, and 1 percent levels. Economic complexity index from OEC up to 1995 and the Atlas from 1995 and rebased as needed to chain the data from the two sources. PWT10 data for capital stock (constant 2017 national prices, in US$, variable name rkna), human capital (index of years of schooling and returns to education, variable name hc), real output, population, and employment. Panel of 133 countries for non-overlapping 5-year averages, that is, 1960-64, 1965-1969, ..., 2010-19. Hausmann tests reject random effects.

ARTIFICIAL INTELLIGENCE IN QATAR: ASSESSING THE POTENTIAL ECONOMIC IMPACTS[1]

Qatar has been actively preparing to embrace the transformative potential of artificial intelligence (AI), allowing it to lead its Emerging Market peers in AI readiness. Qatar's AI exposure has increased significantly over the years, and increasing AI adoption is assessed to yield more opportunities than risks for the country's labor force, thanks to the private sector's contribution in increasing jobs that are more likely to benefit from AI-driven productivity gains. Scenario analyses suggest that increasing AI adoption, supported by policy reforms to boost human capital, innovation and domestic knowledge spillovers, could generate sizeable labor productivity gains over the medium term.

A. Context: Qatar's AI Readiness

1. The world has seen an acceleration of Artificial Intelligence (AI) development and adoption in the past few years. The share of companies adopting AI technologies around the world has more than doubled, from 20 percent in 2017 to 55 percent in 2023. Global private AI investment has expanded five times, from less than $20 billion in 2014 to approximately $100 billion in 2023 (Stanford). According to PWC estimates, AI has the potential to contribute up to $277 billion to the GCC region by 2030, driven mainly by labor productivity gains and consumption side stimulus.

2. Qatar has been proactive in strategic planning for the transformative potential of AI, moving relatively early with high-level initiatives. In 2019, the country launched its first National AI Strategy, focusing on six key sectors: education, data access, employment, business, research, and ethics. This was followed by the establishment of the Artificial Intelligence Committee in 2021, which includes representatives from various ministries, universities, and financial institutions to coordinate AI governance and policy. The national Digital Agenda 2030 reinforces this commitment by positioning AI as a crucial driver of digital transformation across sectors such as government services, healthcare, and finance. The Agenda also lays out AI-specific initiatives (see below) and workforce upskilling programs, supporting the sustainable economic growth objectives in the Third National Development Strategy (NDS3) and Qatar National Vision 2030.

3. Qatar's AI strategies are underpinned by a range of initiatives in digital talent, digital infrastructure, government services, and investments.

- **AI digital talent:** Qatar launched a number of talent development programs in its Digital Agenda 2030. For example, the National Skilling Program, launched in collaboration with Microsoft, is aiming to train 50,000 individuals in advanced digital competencies, including AI and data science by 2025. The Digital Talent Development and Retention Program complements this effort by encouraging local talent to pursue careers in technology through attractive

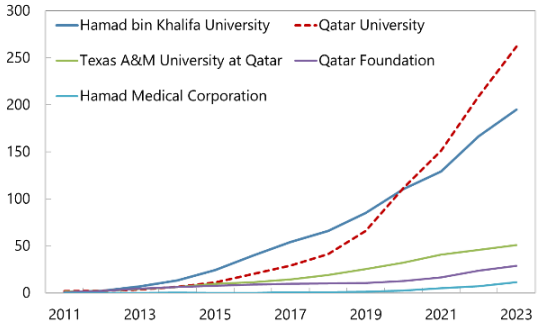
[1] Prepared by Tongfang Yuan. The author would like to thank Ran Bi for very helpful suggestions and comments.

opportunities and incentives, while a fast-track visa system is being introduced to attract global experts in the field. AI research outputs have also surged, with Qatar University being the nation's leading research institution on AI (Figure 1).

- **AI computing infrastructure**: With the rise of large AI models necessitating advanced computing, Qatar is prioritizing the development of high-performance computing (HPC) and planning to establish a National HPC Program to expand cloud-based capabilities for AI, supporting research and new revenue streams. On data centers, Qatar witnessed an annual growth of 45 percent over the last decade, reaching total capacity of 23.5 Megawatts (MW).

Text Figure 1. Qatar: AI Research by Qatari Institutions

(Number of publications, cumulative)



Sources: OECD.AI, and IMF staff calculations.

- **AI for public and labor market services**: For example, the TASMU Smart Qatar program utilizes AI and analytics to meet national goals such as food security and infrastructure optimization. The Labor Market Information System (LMIS) employs AI to provide insights into labor dynamics, facilitating job matching and addressing workforce challenges. The Hukoomi portal also integrated OpenAI GPT to streamline government interactions and enhance operational efficiency

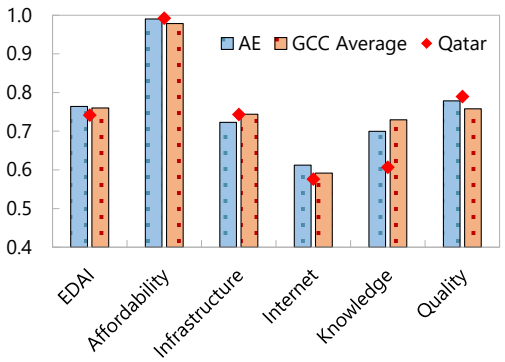
- **AI Investment**: Qatar's investments in the AI sector have picked up and are expected to rise further. A $2.5 billion incentive package was announced in May 2024 to boost investment in AI and digital innovations. The Qatar Investment Authority (QIA) also publicly stressed its continued focus on more AI-related investments in fields such as data centers, data categorization, software applications and semiconductors. Moreover, the Qatari multinational telecom company Ooredoo has secured a landmark QR 2 billion financing deal in September 2024 to accelerate the growth of its data center and AI business, with the aim to build 120MW data center capacity in five years. The company also has an ongoing partnership with Nvidia to develop AI-ready platforms for its clients across MENA.

4. While active efforts have positioned Qatar ahead of its EM peers in AI readiness, there is still room for improvement compared to advanced economies. In terms of digital access, Qatar's digital infrastructure, quality and affordability are relatively advanced and comparable to those in AEs. These advantages, if utilized well, can empower the country for accelerated AI adoption. While digital knowledge in Qatar still lags that in its GCC peers and AEs (Figure 2, panel 1), the Digital Agenda has laid out several digital talent programs aiming to improve the talent gap. In terms of AI readiness, according to Oxford Insights, Qatar is outperforming AE average in government vision and data representativeness, close to AEs on digital capacity, infrastructure and human capital, but with gaps in data availability, governance and ethics, adaptability, maturity and innovation capacity (Figure 2, panel 2).

Text Figure 2. Qatar: Digital Access and AI Readiness

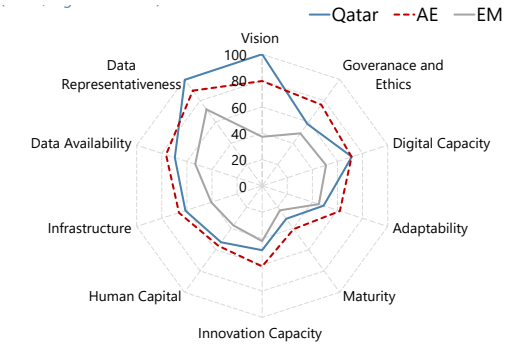
Enhanced Digital Access

(Index, higher = better)



Government AI Readiness Index

(Index, higher = better)



Sources: Forthcoming "Digital Transformation in the GCC Economies" (Fareed, et al. 2024), Oxford Insights, and IMF staff calculations.

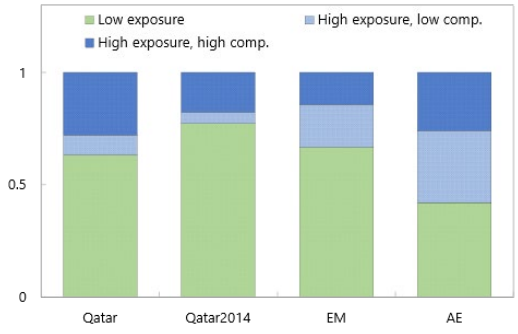
B. Impact of AI Adoption on Qatar's Labor Market

5. The economic impacts of AI are multifaceted and transformative. Literature identifies two main aspects of AI's impact on the labor market: productivity gains and job displacement risk. The extent of these gains or losses remains uncertain, contingent on the pace of AI technology upgrade, adoption by the economy and workforce readiness (Comunale and Manera, 2024). This analysis examines Qatar's labor force preparedness to AI using the analytical framework developed by Felten et al. (2021) and Pizzinelli et al. (2023), which evaluates AI's impact by combining occupational exposure to AI and complementarity by AI: jobs with high AI exposure but low complementarity would entail job displacement risk, whereas jobs with high AI exposure and high complementarity are likely to benefit from productivity and wage gains.

6. Staff analysis shows that Qatar's increased AI exposure is likely to bring more opportunities than risks. As of 2023, around 37 percent of Qatar's labor force see their jobs exposed to AI applications, representing an 18-percentage-point increase from 2014. The AI exposure level is comparable to the EM average (33 percent) but lower than the AE average (58 percent) (Figure 3). Among jobs with high exposure to AI, more than 75 percent also has high 'complementarity' with AI—that is, workers in those jobs will likely find AI helpful to their work and benefit from increased productivity instead of

Text Figure 3. Qatar: AI Exposure and Complementarity

(In percent of employment)

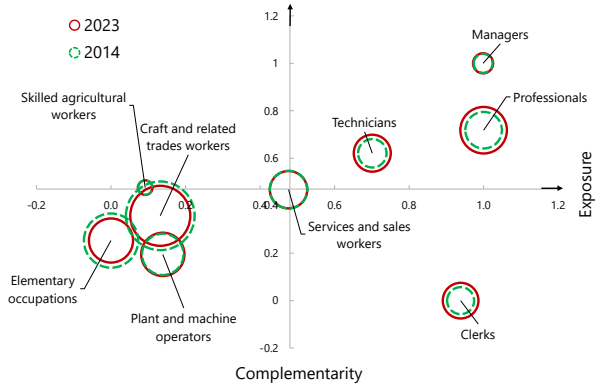


Sources: Qatar PSA, IMF, and staff calculations.

being replaced. Examples of high AI exposure and high complementarity jobs include business executives, engineers, and health professionals (see Annex 1). Qatar's position in labor force AI preparedness (defined as the ratio of high complementarity jobs within the high AI exposure group) is strong (75 percent) when compared to the averages of EM (43 percent) and AE (45 percent).

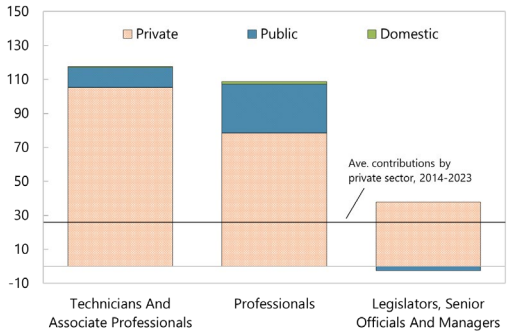
7. Qatar's strong position in the labor force AI preparedness is the result of efforts to create more high-skilled jobs, with the private sector playing a key role. In fact, all high-skilled occupations - managers, professionals, and technicians – fall in the high-AI exposure-high-complementarity territory (Figure 4). Over the past decade, the share of these high-skilled occupations has increased by 10 percentage points in Qatar. The private sector has been the main driver of Qatar's expanding high-skilled workforce. From 2014 to 2023, Qatar's total workforce increased by 30 percent, while the share of high-skilled, AI-benefiting occupations recorded a much higher growth of 87 percent on average, driven mainly by private sector employment (Figure 5).

Text Figure 4. Qatar: AI Exposure and Complementarity by Occupation, 2023
(Higher = more exposure/complementarity) 1/



1/ Bubble size represents share of labor force
Sources: Qatar PSA, IMF, and staff calculations.

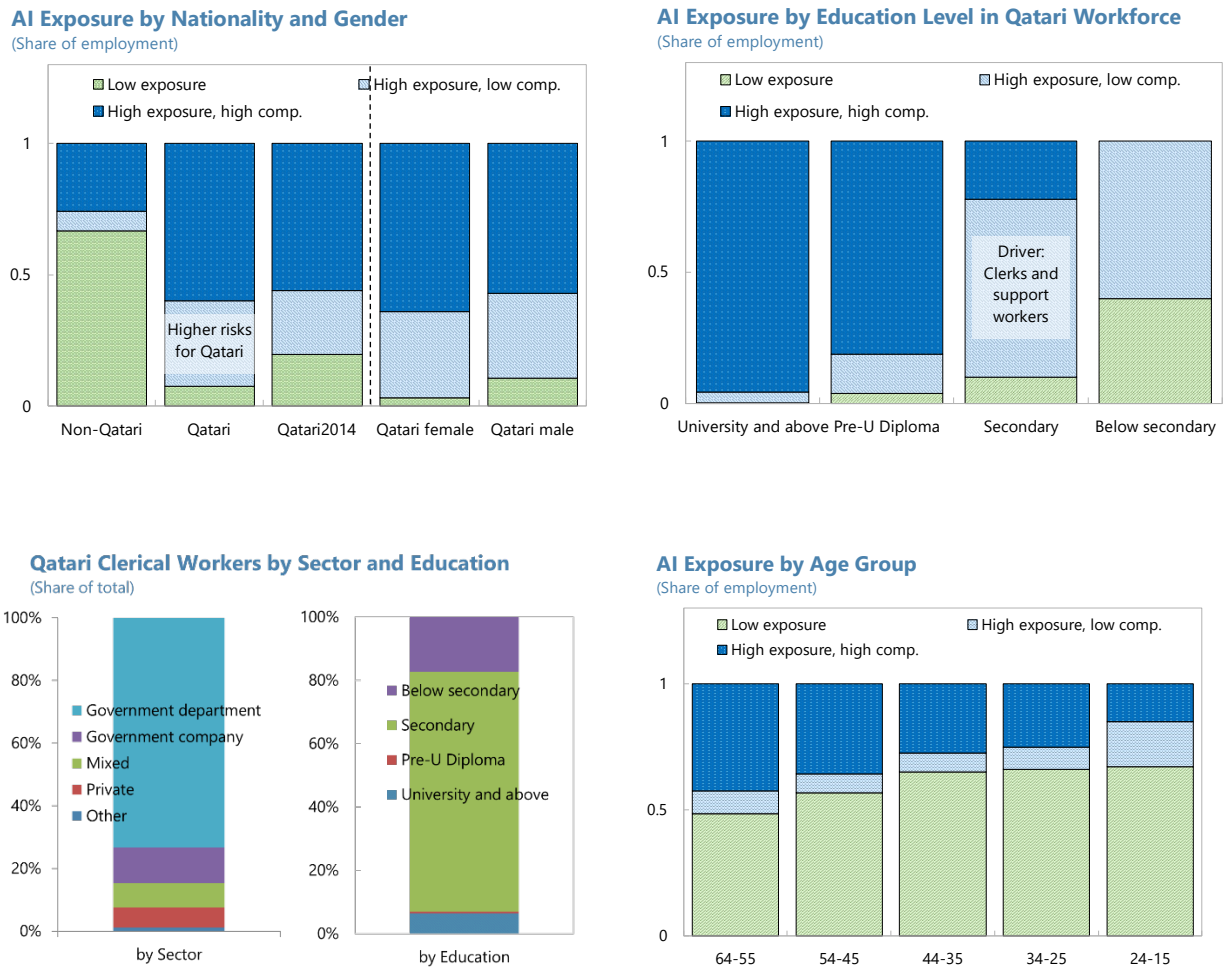
Text Figure 5. Qatar: Increase in High-skilled Jobs, 2014-23
(Contribution to changes, percentage points)



Sources: Qatar PSA, IMF, and staff calculations.

8. The Qatari national workforce, mostly employed in the public sector, faces much higher AI exposure, which could lead to larger potential gains but also job displacement risks. The breakdown of workforce AI exposure by nationality shows that about 93 percent of Qatari workers have jobs exposed to AI, much higher than that among non-Qatari workers (33 percent) (Figure 6, panel 1). Among the high AI-exposure jobs held by Qatar nationals, 65 percent has high AI-complementarity, suggesting opportunities to benefit from AI-driven productivity gains. On the other hand, there is also a sizeable share of jobs held by Qatari nationals that are at risk of being replaced by AI (35 percent). These mainly constitute of clerical support workers (e.g., general office clerks, numerical clerks, and material recording and transport clerks). Data on employment and education status suggests that over 80 percent of the Qatari clerical workers are employed by the public sector and 75 percent of them hold a secondary degree (Figure 6, panel 3). As Qatar deepens government digitalization/AI adoption to enhance efficiency, proactive labor market policies are needed to mitigate job displacement risks for those vulnerable to AI adoption (see policy discussions below).

Text Figure 6. Qatar: Labor Force AI Exposure by Gender, Nationality, Education and Age Group



Sources: Qatar PSA, IMF, and staff calculations.

C. Estimating the Impact of AI Adoption on Qatar's Labor Productivity

9. It is widely believed that AI adoption has the potential to boost productivity, but estimates of AI-driven gains vary and are highly context-dependent. Estimates from existing literature such as firm-level studies have shown increases in productivity, with some reporting gains of up to 6.8% in sales per worker for AI-adopting companies. Private sector analyses such as Goldman Sachs project that AI could add between 0.3 and 3 percentage points to annual productivity growth, depending on the speed and scale of AI adoption. In emerging markets and developing economies (EMDEs), these gains are expected to be lower, with estimates ranging from 0.7 to 1.3 percentage points, reflecting the dominance of sectors with lower AI exposure, such as agriculture (Comunale and Manera, 2024). Overall, while AI has the potential to boost productivity, the magnitude of these gains remains uncertain and highly context dependent.

10. Against this backdrop, a scenario analysis has been deployed to estimate the impact of AI adoption on Qatar's labor productivity. The impact of AI on labor productivity, which is defined as gross value added per worker, depends on the speed of global AI technology advancement, the country's labor force exposure to AI and the speed of AI adoption in the country. The analysis starts with a Baseline Scenario which underpins staff's macroeconomic projections for Qatar over the next five years, where gains from comprehensive reforms (e.g., in enhancing human capital, business environment, private sector growth, and deepening AI penetration) are assumed to gradually lift labor productivity. Three additional scenarios are built around the baseline to estimate the impact of AI adoption at different paces, leveraging estimates of global AI productivity impacts from the existing literature and Qatar's labor force exposure to AI.

(i) A Pessimistic Scenario assuming lower-bound global AI productivity impact and a below historical trend increase in Qatar's AI exposure (+4 ppts cumulatively by 2030) and penetration.

(ii) An Optimistic Scenario leveraging upper-bound productivity impact estimates and sustained gains in Qatar's AI exposure in line with the historical trend (+7 ppts cumulatively by 2030) and penetration.

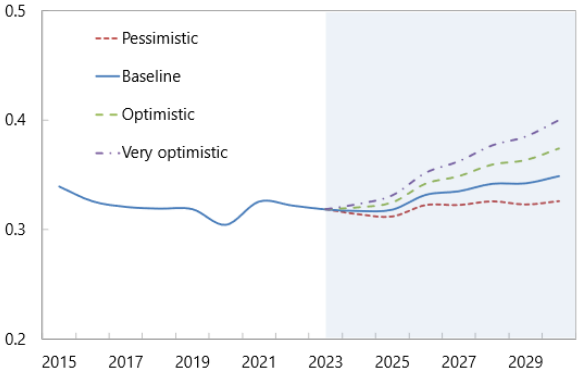
(iii) A Very Optimistic Scenario utilizing top-range global AI productivity impact and very fast increase in Qatar's AI exposure (+11 ppts cumulatively by 2030, reaching an average AE's AI exposure in 2023) and penetration.

For each scenario, we estimate the potential AI-driven productivity boost using the AI exposure metrics in Qatar and the intensity of AI productivity impacts reported globally, based on the formula as follows:

Estimated Productivity Boost = Qatar's AI Exposure and Penetration × Global AI Development and Productivity Impact

11. The scenario analysis suggests that successful AI adoption could generate considerable gains in labor productivity. With the focus on private sector growth, continued investment in human capital and efforts to attract high-skilled expatriates, Qatar's labor force may enjoy more opportunities than risks. Combining existing estimates of global AI productivity impacts and domestic reform gains (to increase AI exposure and deepen AI penetration), the optimistic scenario suggests that Qatar's labor productivity growth could be lifted by an additional 1 percentage point annually (above the baseline scenario). The three different scenarios point to potential labor productivity growth differential (from

Text Figure 7. Qatar: Labor Productivity by Scenarios
(Million GDP per worker)

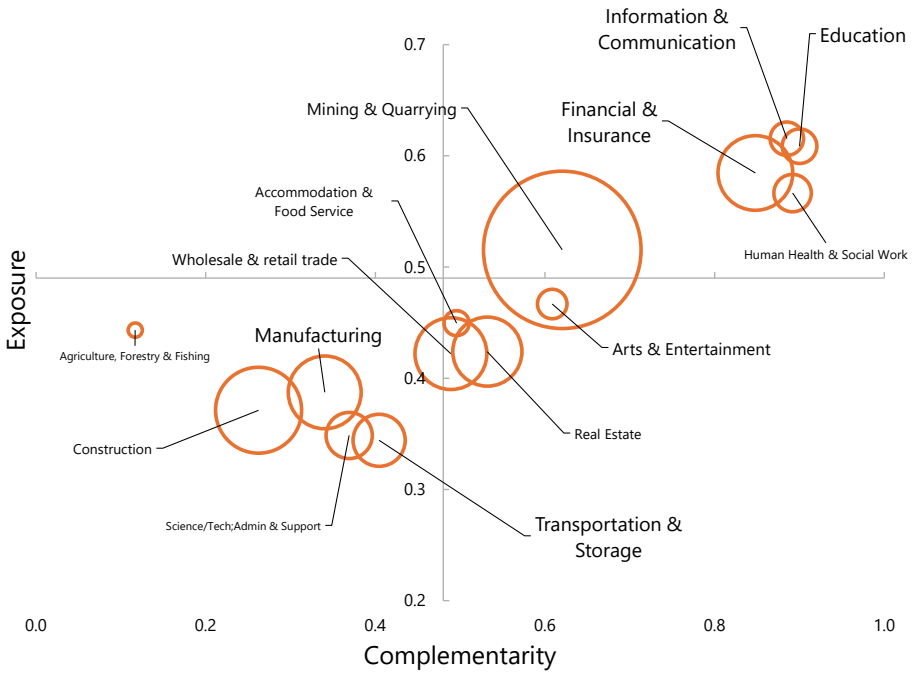


Sources: Qatar PSA, IMF, and staff calculations.

the baseline) ranging from -0.8 (under the pessimistic scenario) to 1.7 (under the very optimistic scenario) percentage points.

12. Several NDS3 "enabling clusters" are well positioned to harness AI-driven productivity gains. The NDS3 identifies IT & Digital, Financial Services, and Education as the 'enabling clusters' that support diversification efforts. By matching the occupational composition of each economic sector in Qatar with the AI exposure-complementarity matrix, we find that the 'enabling' sectors concentrate in the high AI exposure and complementarity quadrant (Figure 8), indicating that they are better positioned, compared to other sectors, to benefit from productivity gains from AI adoption. In contrast, key 'growth clusters' identified in NDS3, such as Manufacturing, Logistics, and Tourism have limited exposure to AI and hence remain largely shielded from both risks and opportunities related to the technology.

Text Figure 8. Qatar: AI Exposure by Economic Sector, 2023
(Higher = more exposure/complementarity) 1/



1/ Bubble size represents share of GDP
Sources: Qatar PSA, IMF, and staff calculations.

D. Conclusions

13. Overall, Qatar is well positioned to benefit from AI-boosted productivity gains. The country's proactive approach in enhancing digitalization and embracing AI have bolstered its digital access and AI readiness, facilitating a rapid increase in AI exposure and labor force AI preparedness. The country's increased AI exposure is expected to bring more AI-driven productivity gains than risks. Its expatriate-dominated labor structure also allows the country more flexibility in adjusting its labor force for swifter AI adoption.

14. The private sector plays a critical role in advancing AI adoption, creating job opportunities that align with AI's transformative potential. Private sector's dynamism is pivotal in generating high-skilled employment that could better leverage AI, thereby contributing to future productivity gains. Estimates suggest that further AI adoption in Qatar could significantly boost productivity, with potential gains varying based on factors such as speed of adoption and labor force exposure. However, it is important to recognize that despite the overall advantageous position of Qatari workers, those who are employed in the public sector with clerical positions are more susceptible to job displacement risks associated with AI.

15. Efforts to deepen digitalization and AI adoption should strengthen with policies in place to address potential job displacement risks. The government could enhance digital skills of the labor force through targeted upskilling and reskilling programs and digital talent attraction schemes for expatriate workers, facilitate job transition including from the public to the private sector to mitigate job displacement risks, and develop adequate and well-targeted social safety nets to support vulnerable groups.

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Annex I. ILO - International Standard Classification of Occupations 2008

major	major_label	sub_major	description
1	Managers	11	Chief Executives, Senior Officials and Legislators
		12	Administrative and Commercial Managers
		13	Production and Specialized Services Managers
		14	Hospitality, Retail and Other Services Managers
2	Professionals	21	Science and Engineering Professionals
		22	Health Professionals
		23	Teaching Professionals
		24	Business and Administration Professionals
		25	Information and Communications Technology Professionals
		26	Legal, Social and Cultural Professionals
3	Technicians and Associate Professionals	31	Science and Engineering Associate Professionals
		32	Health Associate Professionals
		33	Business and Administration Associate Professionals
		34	Legal, Social, Cultural and Related Associate Professionals
		35	Information and Communications Technicians
4	Clerical Support Workers	41	General and Keyboard Clerks
		42	Customer Services Clerks
		43	Numerical and Material Recording Clerks
		44	Other Clerical Support Workers
5	Services And Sales Workers	51	Personal Services Workers
		52	Sales Workers
		53	Personal Care Workers
		54	Protective Services Workers
6	Skilled Agricultural, Forestry and Fishery Workers	61	Market-oriented Skilled Agricultural Workers
		62	Market-oriented Skilled Forestry, Fishery and Hunting Workers
		63	Subsistence Farmers, Fishers, Hunters and Gatherers
7	Craft and Related Trades Workers	71	Building and Related Trades Workers (excluding Electricians)
		72	Metal, Machinery and Related Trades Workers
		73	Handicraft and Printing Workers
		74	Electrical and Electronics Trades Workers
		75	Food Processing, Woodworking, Garment and Other Craft and Related Trades Workers
8	Plant and Machine Operators and Assemblers	81	Stationary Plant and Machine Operators
		82	Assemblers
		83	Drivers and Mobile Plant Operators
9	Elementary Occupations	91	Cleaners and Helpers
		92	Agricultural, Forestry and Fishery Labourers
		93	Labourers in Mining, Construction, Manufacturing and Transport
		94	Food Preparation Assistants
		95	Street and Related Sales and Services Workers
		96	Refuse Workers and Other Elementary Workers