Reassessing GDP Growth in Countries with Statistical Shortcomings

A Case Study on Turkmenistan

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Reassessing GDP Growth in Countries with Statistical Shortcomings – A Case Study on Turkmenistan
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ABSTRACT: Reliable national accounts are essential for proper economic analyses and informed policymaking by national authorities as well as other stakeholders. Nevertheless, in many countries, national accounts statistics are subject to serious shortcomings, which are often manifested as overestimated growth rates. In cases where official data are not adequate for surveillance, IMF staff compile alternative estimates by applying various forecasting methods. This study proposes a more holistic, bottom-up approach, which is based on the compilation of GDP by the expenditure method with limited source data. The study also discusses the case of Turkmenistan, where this method was implemented in practice.

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Contents

Glossary

BEC: Broad Economic Categories

BIS: Bank for International Settlements

BoP: Balance of payments

CCA: Caucasus and Central Asia

CPI: Consumer price index

GDP: Gross domestic product

HS: Harmonized System (a.k.a. Harmonized Commodity Description and Coding System)

PMER: Parallel-market exchange rates

SNA: System of National Accounts

UN Comtrade: United Nations Commodity Trade Statistics Database

Executive Summary

Reliable official statistics, in particular national accounts data, lie at the core of sound economic analyses and policy making, which in turn, is the key to building strong, sustainable, and balanced economies. Many countries however suffer from the shortcomings in their GDP statistics, complicating the efforts to come up with a plausible narrative about the economy and thus, leading to policy mistakes.

In cases, where data shortcomings are particularly severe, independent analysts, including IMF staff, occasionally compile alternative estimates of GDP growth by referring to external data sources and applying various forecasting methods. However, most of these estimates capture only a singular aspect of the economy, thereby offering a limited degree of confidence on the outcomes. In an attempt to address this gap, this study proposes a holistic, bottom-up approach, which is based on the compilation of GDP by the expenditure method with limited source data.

More specifically, this paper argues that imports – as they represent a sizable share of the economic activity in many countries and that they are linked to the activity trends in various sectors – could constitute a reasonable basis for estimating GDP in open economies. Data on traded goods have another analytical vantage point as they can be verified by counter-party trade statistics at the bilateral (e.g., customs data by trading partners) or multilateral level (e.g., UN Comtrade database). Therefore, the proposed analytical template follows the Harmonized System to classify traded products and links the volume changes in imported inputs to the output growth in related sectors. The paper also features an application of this template with a case study on Turkmenistan, including several robustness checks to test the reliability of the findings. This case study attempts further to address the challenges of estimating deflators by capturing price (and exchange rate) developments in both the formal and the informal economy.

Given the potentially contentious nature of compiling alternative GDP estimates, maintaining an open communication channel with the country authorities is critical, including by ensuring the transparency of the methodological underpinnings and the potential sources of information. The objective of this exercise is to complement official statistics and facilitate alignment of domestic statistical methodologies with international best practices. Crucially, the quality of official estimates is critical in assessing the cyclical position of the economy, which in turn, will have implications for the design of the macro policy mix. Therefore, the policy aspect should appropriately be emphasized in the engagement with the authorities.

A candid discussion of different estimates may reveal the need for capacity development and open avenues for further engagement with the authorities. The Fund's readiness to provide technical assistance, including through the regional capacity development centers, is a crucial asset in this regard.

I. Introduction

Reliable national accounts statistics is a *sine-qua-non* for an accurate assessment of the economic situation and designing an appropriate policy response that would help lift living standards and build economic resilience. Despite its crucial importance, estimates of GDP suffer from various shortcomings in a large number of countries (e.g., in particular, low-income and fragile countries), making it difficult to come up with a plausible narrative about the state of the economy and thus, leading to policy mistakes.

The sources and severity of statistical issues are inherently country specific. Some countries have very limited or no institutional capacity (e.g., fragile, conflict-affected states), whereas in other countries, statistical problems can be attributed to data integrity and transparency issues. In most cases (where statistical deficiencies are present), the degree to which domestic statistical practices deviate from international best practices, may not be immediately obvious to the authorities and other stakeholders. In cases, where data shortcomings are particularly severe, independent analysts and even central banks occasionally resort to alternative data sources (e.g., based on satellite imagery) to draw inferences about the true state of the economic activity and inform their decisions. However, most of these external estimates capture only a singular aspect of the economy (e.g., nightlights, flaring data and hydrocarbon output, precipitation patterns and crop yield, shipping and freight data, etc.), thereby offering a limited degree of confidence on the outcomes.

In an attempt to address this gap, this study proposes a methodical approach to enhance the estimation of GDP growth in countries with severe statistical shortcomings. Observing that imports represent a sizable share of the economic activity in many economies, and that they could provide useful insights about the trends in various sectors; the paper will lay out a template that (i) follows the Harmonized System Codes to classify traded products and (ii) links the volume changes in these categories of imported inputs to the output growth in related sectors. The paper will demonstrate an application of this template with a case study on Turkmenistan, including several robustness checks ensuring the reliability of the findings. By introducing a new approach to assess the economic activity, this tool could facilitate more substantive discussions with the authorities about the state of the economy as well as the appropriateness of their policies. Such in-depth discussions could also be useful in identifying priorities for future capacity development engagement that would aim to bridge the gap between domestic statistical methodologies and international best practices.

The paper is organized as follows. Building on a detailed description of the underlying methodology and data sources, Section II presents a template for estimating GDP by expenditure components. Section III fleshes out this discussion with a case study on Turkmenistan. This section also covers several robustness checks, featuring (i) an empirical cross-country model of sectoral indicators, (ii) a narrative-based approach drawing from IMF staff reports and external analyst reports to compile a timeline of key events affecting economic activity, and (iii) various growth elasticities (e.g., based on tax and non-tax revenues, and imports) and metrics (e.g., the course of the parallel market exchange rate). Section IV elaborates on the policy implications and concludes.

II. Methodology and Data Sources

This study proposes a bottom-up approach to estimating GDP based on the expenditure method. The method is applied in cases where (i) official data are not available or (ii) published official statistics use only official exchange rates, while parallel market exchange rates (PMER) that differ significantly from the official exchange rates are not recognized by the country authorities (Figure 2.1). While the official GDP data are not considered reliable in such cases, alternative estimates could be produced based on external data sources as much of the necessary data may be available. For example, information on exports and imports of goods may be available in the official data of a given country's trading partners.

GDP by expenditure is algebraically expressed by the well-known formula:

$$GDP = C + G + I + X - M$$

where **C** stands for household final consumption, **G** government final consumption, **I** investment, **X** exports, and **M** imports.

Figure 2.1. Bottom-up Approach to Estimating GDP by Expenditure
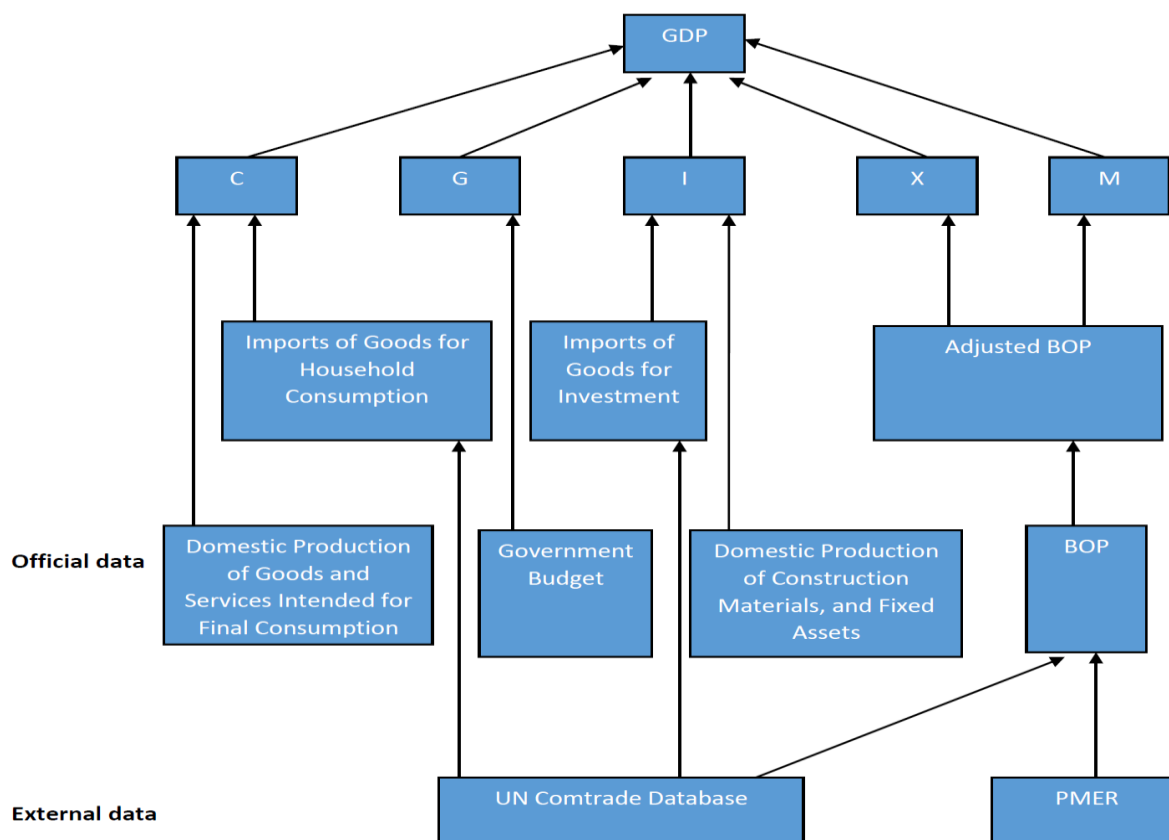
At the initial stage, all available data should be collected from external sources. External data may include exports and imports of goods from the UN Comtrade Database. It may also include PMER, and forecasts of international organizations on agricultural and industrial production.

The next step is to collect all available official data. Official data may include agricultural and industrial production, output of services, the government budget, and balance of payments (BoP). Depending on the specifics of a particular country's statistical system, official data may be available at different levels of detail. It may also include data on retail turnover and investment. However, much of the official data may be unreliable, especially if it is affected by exchange rates. In some cases, compilation methods may contain significant shortcomings. Therefore, it is better to cross-check official data against external sources.

With the foreign trade data reflected in the UN Comtrade Database, it is possible to determine the trend of exports and imports of goods, as well as the trend of imported goods for investment and household consumption. As expressed by the GDP by expenditure formula, imports of goods have a direct and significant impact on the output in many countries. Imported goods also indirectly affect GDP, through investment and household consumption.

PMER should be considered when converting the BoP estimates in the national currency. The official exchange rate should be maintained for government transactions, while the portion of imports that go to the private sector should be converted into the national currency by applying PMER.

The UN Comtrade Database provides access to detailed global trade data. It contains monthly data on exports and imports of goods at the detailed level of the Harmonized System (HS) classification. The HS six-digit codes can be converted into the Classification by Broad Economic Categories (BEC), which correlates the goods to macroeconomic categories (capital goods, goods for intermediate consumption, and goods for final consumption) and is therefore of particular importance to this study.

In some cases, official BoP data are available only at an aggregated level. In this case, data on total exports and imports may be broken down by applying detailed data from the UN Comtrade Database. If official statistics are available at the six-digit level of the HS, then it is possible to compare these data with the UN Comtrade Database. In case of small discrepancies, the official statistics are preferred, but if the discrepancies are large and the statistical system of the trading partner country are more reliable, then the official statistics are adjusted by using the trading partner's data from the UN Comtrade Database.

The fourth revision of BEC at the most detailed three-digit level is directly linked to the one of these end-use categories: Intermediate consumption, Gross fixed capital formation, and final consumption (please see figure 2.2). For the purposes of this study, construction materials are considered as investment flows and separated from intermediate consumption. Time series of imports and exports by these four categories provides important information for economic analysis, especially, if the imports of goods constitute a significant share in the economy. In this case, this information can be used to assess economic performance and forecast GDP.

The UN Comtrade Database includes data on both value and volume of exports and imports. Therefore, time series of exports and imports are compiled at both current and constant prices. The so-called hybrid approach is used in the compilation of imports at constant prices, which means that unit volume indices are used for homogeneous products, and non-homogeneous products are deflated by applying price indices of the main trading partner countries.

Figure 2.2. Relationships between BEC and SNA End-use Categories
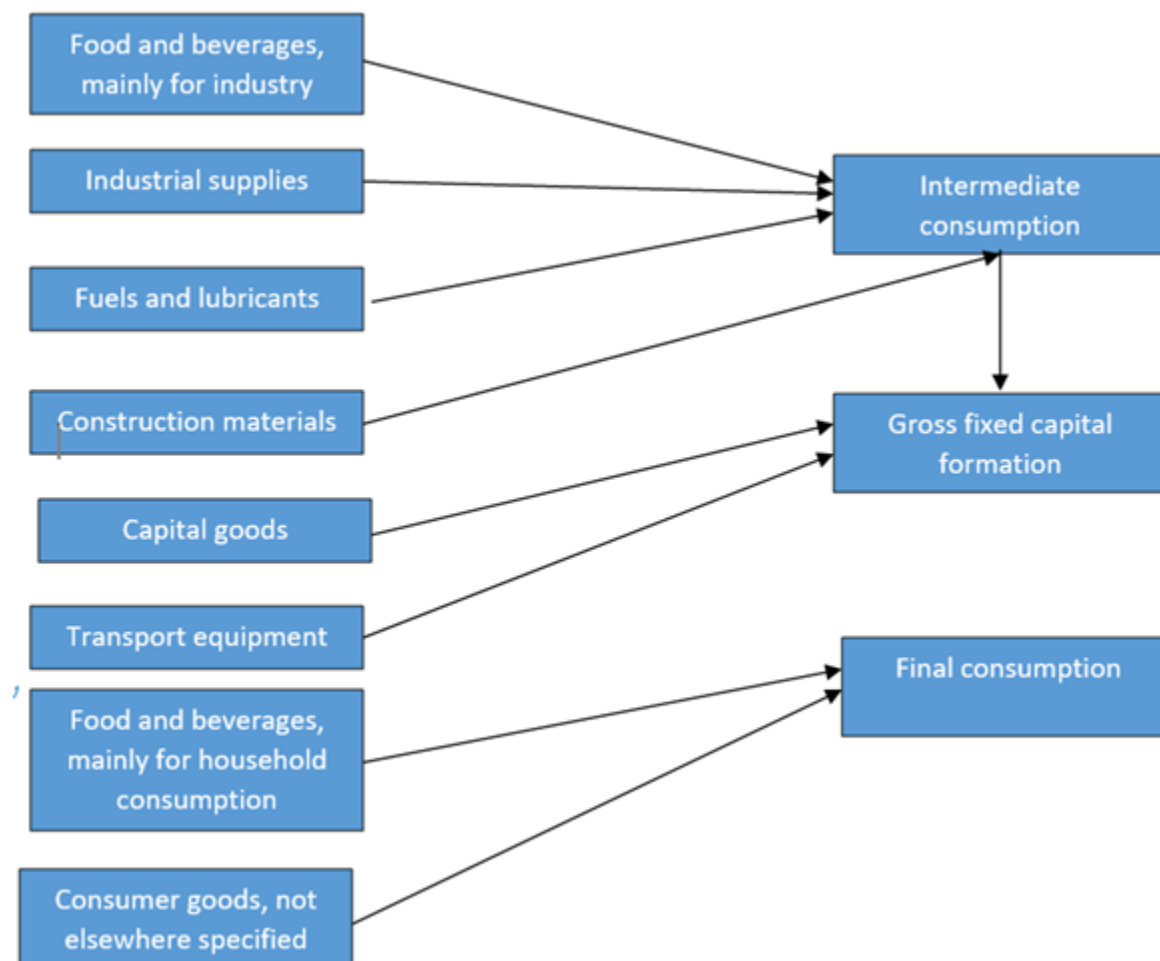
Domestic data sources may include the value and volume of domestic production in agriculture and various branches of industry, government budget data, official price indices, balance of payments, etc. All official data should be collected at the highest level of detail available. In this case, the indicators are also classified according to the end-use categories. It is important to separate the domestic production of construction materials from the other goods for intermediate consumption as they are strongly correlated with construction activity and can be a good proxy for gross fixed capital formation (rather than being an element of private consumption). If this information is not available, then estimates based on the import of construction materials and government budget expenditures on the construction of public infrastructure may be used.

If data on domestic production are not available, estimates can be based on imports of input materials. For example, the output of the chemical industry can be measured by the import of raw materials used in its production process. Imputed rent of owner-occupied dwellings can be estimated by applying observations from

similar/peer economies. In some cases, when internal data sources are not available for non-monetary household consumption, estimates can be based on available data on agricultural and industrial output.

Table 2.1 Sources for the estimation of GDP components when official data are not available

GDP components	Alternative Sources or Methods of Estimation
Household Consumption	
Monetary consumption	
Goods	
Domestic Agriculture	Satellite-based data and/or third-party (e.g., USDA) projections of harvest by main agricultural products
Domestic Industry	UN Comtrade – Imports of goods mainly used for intermediate consumption
Imported	UN Comtrade – Imports of agricultural and industrial products mainly used for final consumption
Services	Expert estimates based on household consumption per capita in peer countries
Non-monetary consumption	
Goods	
Agriculture	Expert estimates based on the share of own consumption in the output of agriculture in peer countries
Industry	Expert estimates based on the same indicator in peer countries
Services	Expert estimates based on the share of imputed rent of owner-occupied dwellings in the total GDP in peer countries
Gross Capital Formation	
Construction	
Domestic materials	UN Comtrade – Imports of goods mainly used for intermediate consumption
Imported materials	UN Comtrade – Imports of construction materials
Machinery and equipment	
Domestic production	UN Comtrade – Imports of goods mainly used for intermediate consumption
Imported	UN Comtrade – Imports of machinery and equipment mainly used for gross fixed capital formation
Cultivated Biological Assets	Expert estimates based on the same indicator in peer countries
Exports	
Goods	UN Comtrade Database
Services	Expert estimates based on the available data from the World Bank *Trade in Services Database*
Imports	
Goods	UN Comtrade Database
Services	Expert estimates based on the available data from the World Bank *Trade in Services Database*

Both internal and external data sources should be used with caution, as in some cases their quality may be compromised. Some internal data sources may not account for PMER, which affects data quality. In addition, the compilation methodology for some indicators may contain significant shortcomings. When using the data from the UN Comtrade database, it is important to consider the quality of the official statistics of the trading partner country - if the quality is poor, then using these data is inappropriate. Users of UN Comtrade database should also be aware of the issues pertaining to the coverage of data, as some trading partners may not be reporting to the database in the given period.

The success of this study depends crucially on the reliability of underlying data sources, and therefore, the results should be interpreted judiciously. It is recommended that the study results be compared with the results obtained from applying other forecasting methods (top-down approaches). In case of a large discrepancy, the data sources used should be re-examined.

III. Case Study on Turkmenistan (2008 – 2020)

Concerns about the availability and reliability of Turkmenistan's official statistics, in particular GDP data, have long been shared by stakeholders involved in the country (e.g., international organizations, financial community, bilateral trade and investment partners, credit rating agencies, and independent forecasters). During the first year of the COVID-19 pandemic, these concerns intensified as the official narrative of continued strong economic expansion (i.e., at around 6 percent), contrasted with the global and regional experience, especially given larger shocks and the smaller policy response in the country.

Unlike the official, production-side statistics, this study focused on estimating GDP by expenditure components as the latter is analytically easier to construct and verify. The analysis largely drew raw data from Turkmenistan's official sources such as statistical yearbooks, state budget statistics, and monetary surveys while applying international best practice methodologies. Other, bilateral and multilateral sources (e.g., UN – Comtrade Database, IMF - Direction of Trade Statistics, World Bank - Trade in Services Database, BIS – Locational Banking Statistics, US Department of Agriculture – World Agriculture Supply and Demand Estimates) were used to fill in data gaps and cross-check official data. This methodology is also broadly used by the IMF Turkmenistan team to underpin their assessments in the bilateral and multilateral surveillance reports. The approach[1] for estimating individual components is described in detail below:

- *Private Consumption.* Household consumption estimates were derived through a bottom-up approach following the structure presented in Figure 3.1 below.

Figure 3.1. Bottom-up Approach to Estimating Private Consumption

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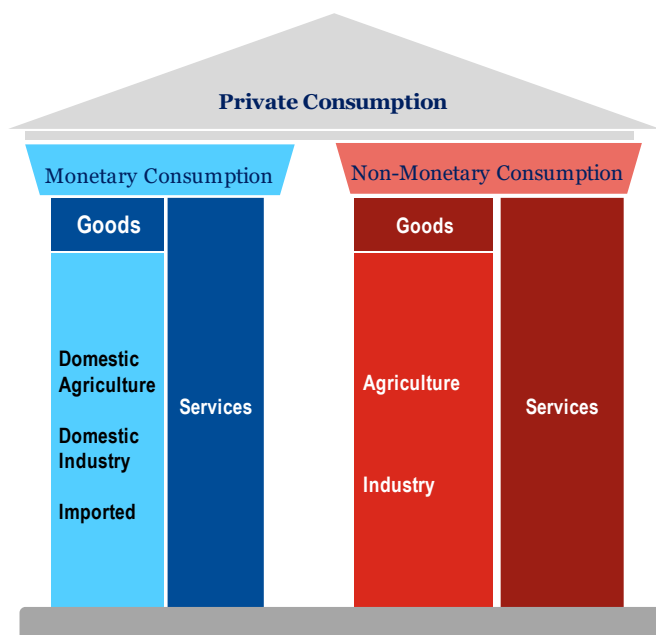
[1] Since the source data are often available at an annual frequency, the approach presented here is best applicable to yearly estimates.

o *Monetary and Non-Monetary Consumption.* In compiling the estimates of GDP, besides monetary consumption, which is transactional in nature, it is important to take into account the consumption of goods and services that are produced by households for their own final use. The most common examples of unpaid consumption of goods and services include agricultural products for own final use, food manufactured for own final use, and imputed rent of owner-occupied dwellings. Since Turkmenistan does not publish any official data in this area, the share of non-monetary consumption is estimated based on the observations from peer countries[2] which share similar characteristics (e.g., income per capita, commodity endowment, trade openness, etc.). It is also assumed that non-monetary consumption of goods grows in step with the total output in their respective sectors (e.g., agriculture, industry). As for the non-monetary consumption of services, in many economies, imputed rent emerges as the highest contributor to GDP in this sub-category. Therefore, growth of imputed rent – which is linked in this case to the population projections by the UN[3] – is used as a proxy to the overall change in the unpaid services consumed by households. In other cases, housing stock growth rates – where available and reliable – can also be used to estimate the change in imputed rent.

o *Domestic Agriculture.* Official Statistical Yearbook of Turkmenistan includes raw, product-level data on agricultural output (e.g., grains, cotton, fruits and vegetables, animal products, etc.) which allows to calculate volume growth for each agricultural product. These individual growth rates were subsequently weighed with respect to their monetary values to compile the total growth in domestic agriculture sector. Monetary values of the agricultural products are simply calculated by multiplying the total volume measured in metric tons by the international prices[4]. To ensure robustness, the calculated agricultural output growth was compared to external estimates (e.g., by US Department of Agriculture) as well as crop and precipitation developments captured by satellite data. In cases where data on agricultural yields are not available or reliable, growth of imported inputs (e.g., fertilizers, agricultural machinery, pesticides, etc.) could also provide broad insights about the developments in this sector.

o *Domestic Industry.* Official Statistical Yearbook gives insights about the breakdown of manufacturing activity (i.e., food, textiles, construction materials, and chemicals) in Turkmenistan beyond the pre-dominant hydrocarbon extraction. The weight of each industrial sub-sector is estimated with respect to their shares in imported inputs. Similarly, the growth estimates of industry sub-sectors are based on the changes in the (domestic and imported) supply of key inputs (e.g., grains, fruits-vegetables, and dairy-meat – food industry; cotton fibers – textile industry; cement, gypsum, and glass – construction materials industry, etc.), excluding known stock changes.

o *Imported.* This component simply traces the volume changes in consumption goods' imports. Incomplete data from official sources are cross-checked against and supplemented by counter-party trade data[5] (e.g., from bilateral sources or UN COMTRADE database).

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[2] Peer countries are selected by applying three basic criteria: (i) Geographical proximity, (ii) structural similarity (e.g., hydrocarbon exporter) and a similar level of GDP per capita adjusted for purchasing power parity (from the WEO database)

[3] Turkmenistan does not publish the results of census surveys.

[4] Sourced from the Chicago Mercantile Exchange.

[5] The counter-party trade data can be compiled from bilateral trading partners' official statistics – where available, and/or from third-party sources like the UN - Comtrade database or IMF - Direction of Trade Statistics.

- *Government consumption.* Fiscal data are one of the most commonly available economic statistics across all country groups which – with a certain degree of confidence – can provide crucial insights about public sector activity as well as other real developments in an economy. In Turkmenistan, data on state budget are available, and despite certain limitations, are considered to be a reasonable proxy for the trends in the broader public sector. Therefore, to estimate real growth in this component, expenditure data from the state budget is adjusted for capital expenditure outlays as well as social transfers to derive government consumption in current prices. Due to shortcomings in official deflator data, the government consumption series in current prices is deflated by the change in official CPI.

- *Gross Fixed Capital Formation.* Real growth in investments is estimated through two alternative ways. One is a bottom-up approach which directly estimates the real growth rates based on volume changes in inputs (please see Figure 3.2). The second approach takes the authorities' reported investment figures and uses a "combined" deflator metric – capturing price developments in both the formal and informal parts of the economy - to calculate real growth. These two estimates are used as a robustness check against each other, as they are expected to yield similar outcomes.

Figure 3.2. Bottom-up Approach to Estimating Gross Fixed Capital Formation
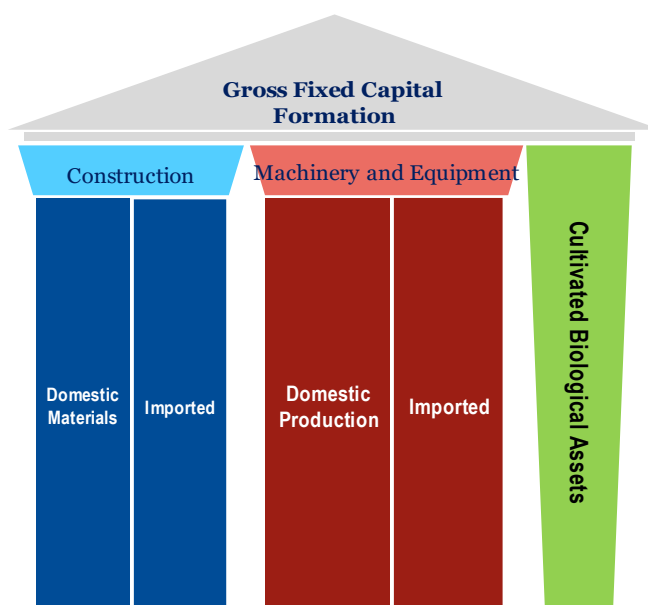

- o *Construction.* In this exercise, real growth in the construction sector is estimated through growth in inputs – both domestically produced and imported. In Turkmenistan, domestic manufacturing in the construction sector is confined essentially to material production (e.g., cement, gypsum, glass), for which volume series can be extracted from the official Statistical Yearbook. For imported inputs (i.e., materials and equipment), data in current prices are drawn from the UN Comtrade database which subsequently are deflated by applying a hybrid approach – unit volume indices represent real growth for homogeneous products, while for non-homogeneous goods, an international price metric (e.g., US CPI) are applied to estimate volume growth. The Official Statistical Yearbook contains the output of construction materials in monetary terms, which is used as the weights for domestically produced products. The weights for imported

construction materials are derived from the import values from the UN Comtrade Database are used as.

o *Machinery and Equipment.* In Turkmenistan, domestic manufacturing of machinery and equipment is a nascent industry. Therefore, changes in machinery and equipment investment can entirely be linked to imports in this category, while the domestic component can be treated as negligeable.

o *Cultivated Biological Assets.* This category statistically captures the stock of live animals and perennial plants, for which raw official data on animal headcounts and tree plantation areas (in thousand hectares) are used to estimate volume growth. In cases where detailed or reasonably reliable data about biological assets cannot be obtained, satellite-based information about the types of land use can be used as a proxy.

o *Official Investment Series.* In a potentially controversial exercise like this, using official figures may appear tempting to render a common denominator with the authorities, especially when it comes to a critical output component like gross fixed capital formation. Nonetheless, even if the official raw data are to be used, due to methodological differences as well as the choice of deflators, resulting real growth estimates could differ quite substantially from the official series.

o *Inventories.* Theoretically, an estimate of gross fixed capital formation should also account for the net changes in the level of inventories. However, in this exercise, due to the lack of reliable official data on the changes in inventories or external data that could be used as a proxy, this parameter is assumed to be "0" throughout the estimation period.

o *"Combined" Deflator Metric:* In this exercise, an alternative measure of deflator is developed to capture price developments in both the formal and informal parts of the economy. In Turkmenistan, although the official exchange rate has remained at 3.5 manats per US dollar since 2015, the parallel exchange rate has depreciated over time, peaking 38 manats per US dollar in April 2021[6]. Official price statistics fall short of fully reflecting the pass-through effect of the rising parallel market premium and thus, underestimate the CPI and GDP deflator. To work around this challenge, the share of parallel market activity is estimated using

Figure 3.3. Official GDP Deflator and Inflation
(In percent change)

Sources: National Authorities, and IMF Staff Calculations.

official data on household consumption surveys and assuming a consumption structure similar to that observed in regional peers (i.e., oil-exporter CCA economies). This approach allowed to differentiate the deflator for economic activities that are likely to have an informal component (e.g., household consumption, private investment) from other activities (e.g., government

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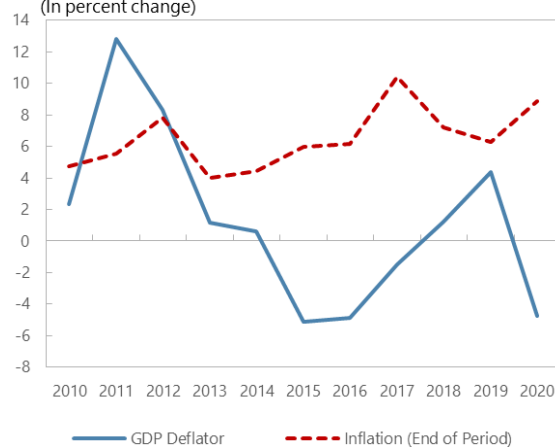
[6] Parallel exchange rate has gradually appreciated since Q2/2021 reflecting a stronger external account and easier financial conditions. *Source: Chronicles of Turkmenistan and IMF staff calculations.*

consumption) in the economy. The resulting upward adjustment of the GDP deflator led to a reduction in real GDP growth rates across the board.

o   *Trade in Goods and Services.* Figure 3.4 summarizes the structure through which the changes in net exports component is estimated.

Figure 3.4. Bottom-up Approach to Estimating Net Exports
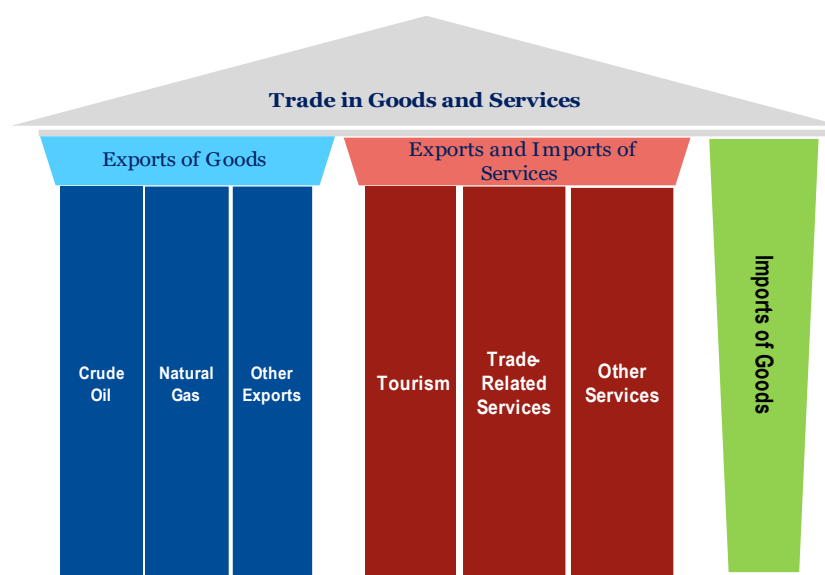
o   *Exports of Goods.* In Turkmenistan, relative to the other accounts of Balance of Payments, data on goods' trade are more accessible and reliable. Nonetheless, as part of this study, official statistics on external trade are verified with counter-party trade statistics at the bilateral (e.g., customs data by trading partners) and/or multilateral level (e.g., UN Comtrade database). In estimating growth of goods exports, proceeds of hydrocarbon commodities are treated separately due to their (i) sheer weight in the overall exports of Turkmenistan (around 80 percent) and importantly, (ii) peculiar price structure, which often deviates from that of the other exported items. While volumes of natural gas exports can directly be linked to the output growth in that year – because of the negligeable storage capacity of the country; for crude oil, a contemporaneous association is not possible due to the inflows to and outflows from inventories. Therefore, as a working assumption, two-year moving averages of export volumes are taken as a proxy for the production of crude oil.

o   *Imports of Goods.* Turkmenistan has a diversified import portfolio, with no single dominant commodity. Therefore, changes in goods' import volumes are estimated by simply deflating the headline import figures by an international price metric (e.g., US CPI).

o   *Exports and Imports of Services.* The structure of Turkmenistan's services trade is estimated by drawing insights from the World Bank's Trade in Services Database. The bulk of the services trade is observed to be associated with goods' trade-related activities (e.g., freight and

transportation, insurance, engineering, etc.). Therefore, the volume change in this category can reasonably be anchored by the change in underlying goods' trade volumes. The estimates of travel-related services can be based on multiple sources, which could include (i) official statistics on number of travelers, (ii) third-party sources (e.g., FlightRadar24) on the number of passenger and cargo flights, or (iii) international payment statistics, e.g., from major credit card companies. Estimating 'other services' is a challenging task, which could be based on a variety of metrics depending on the structure of the economy and observed co-movements. In Turkmenistan's case, given the prevalence of international contractual services for the domestic economy, volume developments in machinery and equipment imports are taken as a proxy for other services' imports. For other services exports, the historical growth rates of such residual activities as observed from the World Bank data is taken as a proxy.
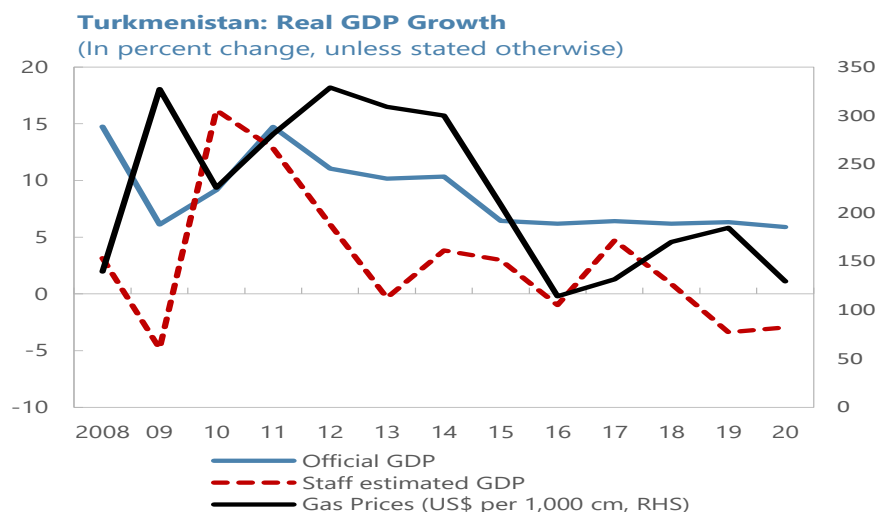
o   Information on capital and financial account, including changes in reserves, were used as a consistency check for the counter-party data on trade in goods and services. For the estimates of international reserves[7], net foreign assets data derived from the official monetary survey was used as a proxy, which was also verified using the BIS data on Turkmenistan's holdings in international banks.

The results are presented in Table 3.1 and Figure 3.5 below:

Table 3.1. Real GDP Growth by Expenditure Components

	Year-on-Year Growth Rates (In percent change)												
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Household Consumption	2.1	3.4	4.7	1.2	3.5	4.3	0.6	0.1	-1.1	-1.1	-3.1	1.7	3.6
Government Consumption	20.1	37.4	2.2	14.1	-0.1	9.4	15.5	7.2	-4.9	1.9	11.2	-1.6	-4.2
Gross Fixed Capital Formation	10.0	40.5	-4.1	23.3	24.8	3.0	1.6	1.6	-10.5	-19.3	-37.0	-17.8	-8.9
Exports of Goods	5.7	-43.8	42.5	47.5	7.7	0.1	5.3	-12.8	-2.5	18.6	-2.5	7.5	-13.9
Exports of Services	12.3	26.2	17.9	4.1	-5.8	-6.3	-6.5	-1.2	-16.2	5.1	-4.8	0.2	-40.9
Imports of Goods	26.0	54.4	-10.6	35.8	22.0	11.6	1.4	-17.2	-8.1	-24.2	-48.8	7.4	-0.4
Imports of Services	15.4	-16.4	5.2	3.4	5.8	10.3	-8.8	-18.2	-30.5	-19.9	-45.3	21.9	15.3
GDP in Constant Prices	**3.1**	**-4.8**	**16.2**	**12.9**	**6.1**	**-0.3**	**3.8**	**3.0**	**-1.0**	**4.7**	**0.9**	**-3.4**	**-3.0**

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[7] Turkmenistan does not make data on international reserves publicly available.

Figure 3.5. Official and Alternative Estimates of Real GDP Growth in Turkmenistan

Turkmenistan: Real GDP Growth
(In percent change, unless stated otherwise)

Official GDP
Staff estimated GDP
Gas Prices (US$ per 1,000 cm, RHS)

Sources: National authorities, and IMF Staff calculations and estimates.

Several consistency checks are performed to confirm the robustness of the bottom-up growth estimates:

- An empirical cross-country model of sectoral indicators (by Saliba and Yaaqoubi, 2021) was developed and used as a cross-check on the GDP estimates of Turkmenistan. This model estimated sectoral growth contributions to GDP across a sample of 103 hydrocarbon exporters, excluding Turkmenistan[8], between 2000 – 2019. A two-step difference generalized method of moments (GMM) was employed on log-transformed variables given the dynamic behavior of growth. The estimated coefficients are considered also to be applicable to Turkmenistan. This work has been motivated by the team's efforts to document anomalies with the official GDP series and was used internally as an unpublished robustness check.

- A qualitative, event-based approach derived from past IMF staff reports, external analyst reports, and official announcements was used to compile a timeline of key events affecting economic activity (please see Annex 1). While far from being comprehensive, these events could be indicative of some of the prevalent forces affecting economic activity at a given year. Therefore, it is critical to ensure the consistency of narrative implied by these events and the growth path emerging from the quantitative analysis.

- Various growth elasticities (based on tax and non-tax revenues, and imports) and metrics (e.g., PMER) were assessed in a time series and/or in comparison to peer economies to identify possible discrepancies and anomalies or as a directional check, that is to signal growth or contraction in economic activity.

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[8] To avoid model endogeneity as well as due to shortcomings in the official data, Turkmenistan was not included in the sample.

o *Import coverage ratios[9]*. According to international and development economics literature, import income elasticity tends to rise over time especially with rising levels of GDP per capita. This positive relationship between income elasticity of import demand and the level of GDP per capita is mostly explained by the correlation between country's economic development and a growing manufacturing sector.

Turkmenistan's implied import coverage ratio is among the lowest in the region (13.6 percent), despite being one of the least diversified economies (Figure 3.6). Also illustrated in the figure (on the right) is the sharp decline in Turkmenistan's import coverage ratios, starting from 2012.

Figure 3.6. Import Coverage Ratios in the Central Asia and Caucasus Region

Sources: The World Economic Outlook, and IMF Staff Calculations.
Note: Import coverage ratio for oil exporters is in percent of non-oil GDP.
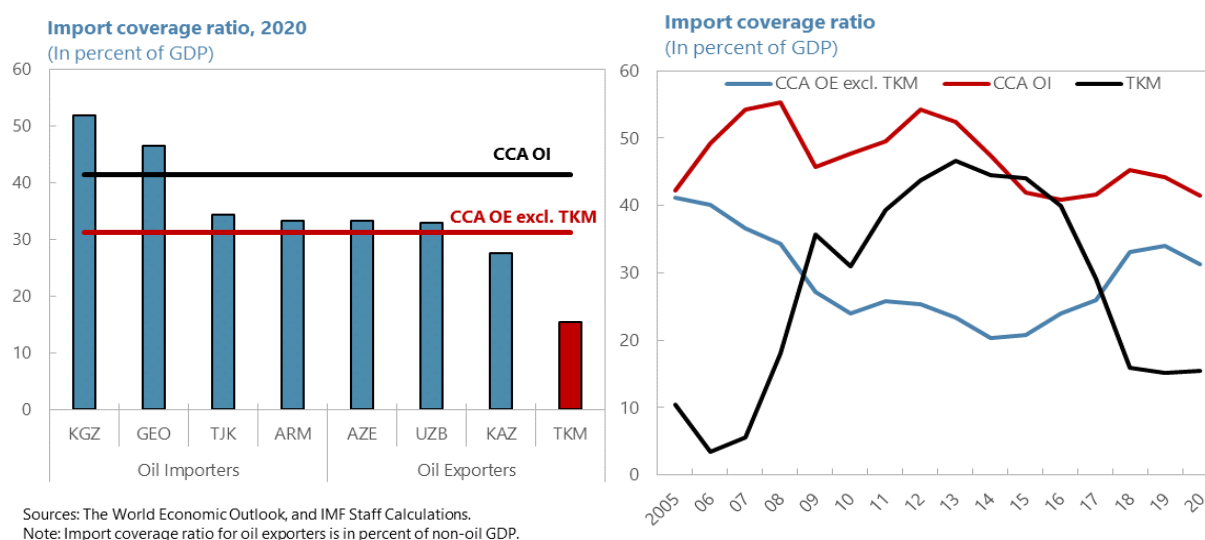
Table 3.2 below lists some historical events coinciding with a sharp decline in real imports by more than 40 percent as well as the associated levels of real GDP growth. It exhibits a consistently positive relationship between import demand and real output growth – with the exception of Turkmenistan, in 2018, which suggests a disconnect between official GDP figures and fluctuations in imports. While the behavior of imports in 2018 is conspicuous in magnitude, the implied disconnect with the official GDP data is not confined to a single year and signals a broader problem, strengthening the case for an alternative, much weaker GDP estimates.

Table 3.2. Incidents of Sharp Import Compression and Associated Output Growth

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[9] Within the context of this study, 'import coverage ratio' refers to the share of imports as a percent of GDP.

Real Imports and Associated Real GDP Growth Rates (In percent, y-o-y change)				
Country	**Year**	**Major Event(s)**	**Real Imports**	**Real GDP**
Sierra Leone	1997	Coup d'état	–61.4%	–17.6%
Libya	2011	Arab Spring	–59.6%	–66.7%
Argentina	2002	Economic Crisis/Depression	–53.2%	–10.9%
Venezuela	2016	Socioeconomic and political crisis	–50.1%	–17.0%
Turkmenistan	**2018**	**Import substitution**	**–48.7%**	**6.2%**
Guinea Bissau	1998	Civil War	–47.4%	–22.4%
DRC	1999	Congo War	–45.1%	–3.8%
Mongolia	2009	Economic Crisis	–44.9%	–2.1%
Moldova	1999	Constitutional Referendum	–43.0%	–3.4%
Burundi	1996	Coup d'état	–41.8%	–8.0%
Republic of Congo	2017	Debt distress	–40.9%	–4.4%

Sources: The World Economic Outlook, and IMF Staff calculations.

- o *Government revenues*[10]. Aggregate fiscal revenues generally bear a close relationship with GDP. One way to capture this relationship is through the tax buoyancy (elasticity) estimates from time-series data, which indicate growth in revenues resulting from a 1 percentage point growth in nominal GDP. Cross-country analysis finds that most tax systems deliver an elasticity close to 1. In the case of Azerbaijan, as a comparator for Turkmenistan, the total revenue (i.e., oil and non-oil, tax and non-tax) to total GDP elasticity was 1.18 and the elasticity for non-oil revenues with respect to non-oil GDP was 1.04. In Turkmenistan, the revenue elasticity estimates appear implausibly low. The elasticities, using data from 1997 to 2019, are 0.85 for total revenues with respect to GDP and 0.87 for non-hydrocarbon revenues to non-hydrocarbon GDP. While other factors may also be leading to a protracted decline in tax elasticities, these estimates could potentially suggest that reported GDP growth tends to exceed actual GDP growth.

Figure 3.7. Fiscal Indicators and Output Growth

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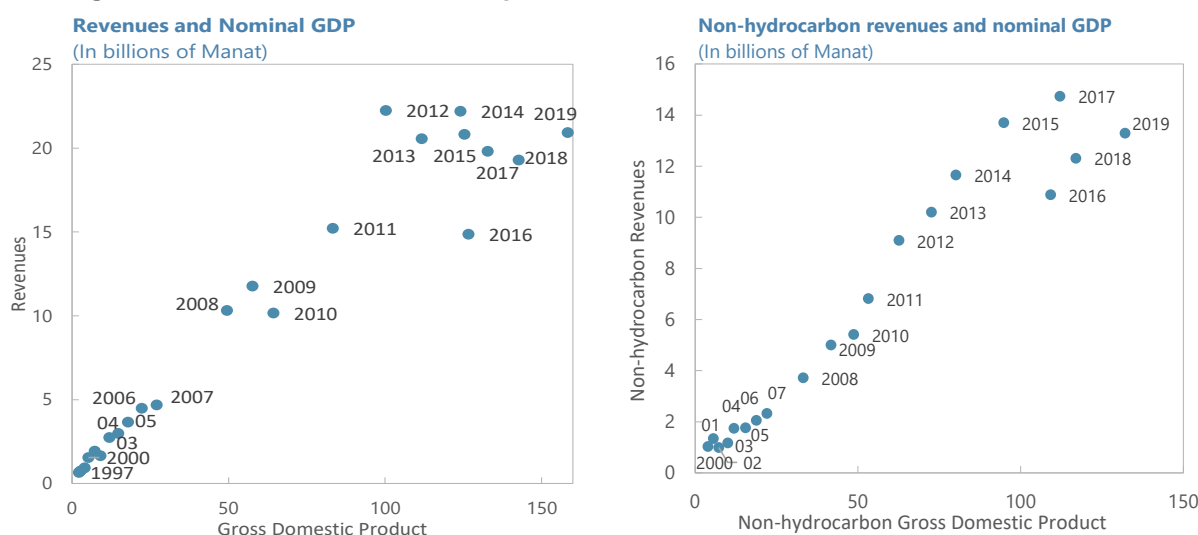
[10] With the courtesy of Jean-Francois Wen (FAD).

- An interesting observation from the first scatter plot is that revenues appear to grow in step with GDP until 2012, after which reported GDP continues to rise each year, but revenues appear stagnant. In the second scatter plot, for the non-hydrocarbon sector, again, we observe a flat level of (non-hydrocarbon) revenues at the higher levels of GDP, i.e., the more recent years.

- *Parallel market exchange rates.* Transactions outside of the official exchange market is deemed illegal in Turkmenistan. This notwithstanding, the trajectory of PMER is accepted to be broadly indicative of the economy-wide stress and pressures on the external account. While official price statistics do not allow a thorough analysis, anecdotal observations from the ground also reveal a strong pass-through from PMER to local prices in the non-state sponsored markets – affecting the household consumption trends. Therefore, the developments in PMER are assessed in a time series and/or in comparison to peer economies to identify discrepancies and anomalies in the official GDP data. This serves as a directional check to signal growth or contraction in economic activity.

Figure 3.8. Parallel Market Exchange Rates in Turkmenistan
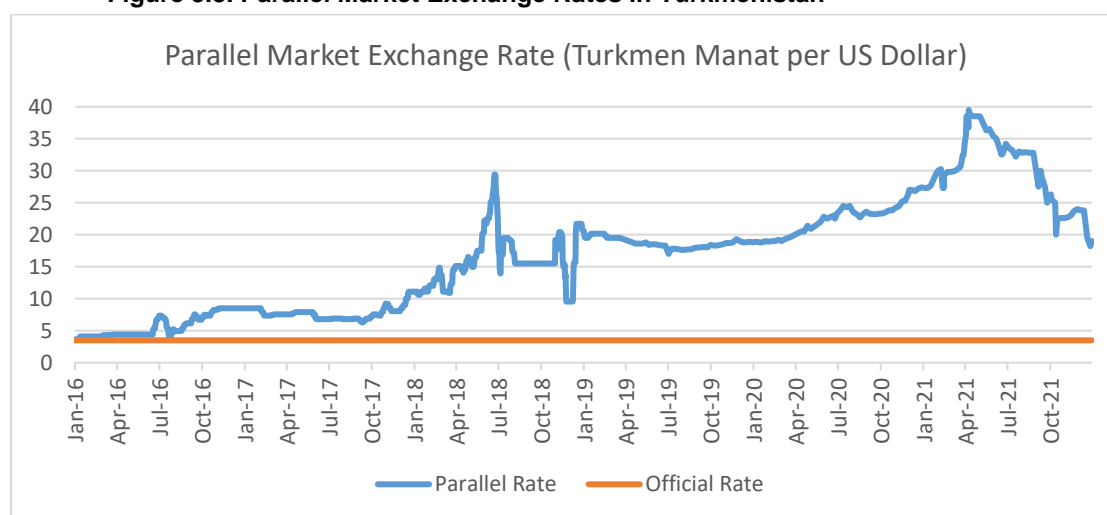
Source: Chronicles of Turkmenistan, Alternative News of Turkmenistan, Radio Azatlyk

IV. Conclusion

In many countries, availability and reliability of national accounts data appear as a major analytical constraint, hindering policy makers' and independent experts' ability to accurately assess the state of the economy and devise an appropriate policy mix. While reasons behind the data-related shortcomings vary, it is possible to estimate GDP growth with a reasonable degree of confidence using a broad set of indicators.

The template described in this study, and exemplified by the case study on Turkmenistan, is a practical tool that can be consistently reproduced for consecutive years and can also be adapted to other country cases where the relationship between imports and critical sectors of the economy can be constructed analytically. While external data sources play a prominent role in this analytical construct; official data – especially raw, sectoral data – should continue to have a role. The objective of the analysis is to complement official statistics in most cases, as well as to facilitate alignment of domestic statistical methodologies with the international best practices.

To the extent that the alternative GDP estimates diverge from the official series and thus, imply a different cyclical position of the economy, there will be implications for the design of the macro policy mix. For example, in a case where the true state of an economy is a recession, but the official narrative suggests continued, uninterrupted growth; a contractionary policy mix encouraged by the strength of the official GDP growth data, may deepen, and prolong the recession.

Therefore, despite the potentially contentious nature of this exercise, it is critical to maintain an open communication channel with the authorities, including by ensuring the transparency of the methodological underpinnings and putting a due emphasis on the policy implications. Disagreements on the methodological underpinnings, if managed well, could appropriately trigger a stronger appetite for technical assistance engagement with the Fund and other development partners, as a means to address immediate domestic capacity deficits and bridge methodological divergences. The IMF's firm commitment to delivering capacity development support, including through regional technical assistance centers, is a crucial facilitator in this regard.

Lastly, the IMF's Institute for Capacity Development may consider designing standardized training programs (including case studies) for staff who are assigned to countries with serious statistical shortcomings and may need to come up with alternative methods for assessing GDP trends. This would help to improve the reliability of the IMF's macroeconomic estimates and projections, and policy advice.

Annex I. Turkmenistan: Main Events

Year	Event
2008	Increased hydrocarbon export prices and export outlets.
	Growth in the non-hydrocarbon sector boosted by public spending on rural development and infrastructure.
	January 1, 2008: Devaluation of the official exchange rate to manat 6,250 per US dollar. Introduction of a commercial rate of manat 20,000 per US dollar to virtually eliminate the parallel market.
	May 1, 2008: the exchange rates were unified at the rate of manat 14,250 per US dollar.
2009	Global recession and collapse in hydrocarbon prices.
	Gas exports to Russia were disrupted for nine months.
	National currency is re-based with a ratio of 5000 old manats = 1 new manat.
	Disbursement of a major Chinese loan package (US$ 4bn. - hydrocarbon development).
	High public spending and high FDI inflows, concentrating on the energy sector.
2010	Resumed gas exports to Russia. Increased volumes through new pipelines to China and Iran that became operational by early 2010.
	Continued expansion of public investment.
	US intensified sanctions on Iran.
2012	Doubling of proven gas reserves.
	Cancellation of the Turkmenistan-Iran railway project (900 km. – US$ 700m). Lower-than-expected gas deliveries to Iran following sanctions and the difficulties Iran encountered in paying their dues.
2013	*Galkinish* gas field came on stream (September), with near-full capacity operationalization expected in 2014 (creating strong base effects for 2015).
2014	Triple shock: Sudden and steep fall in energy prices, spillovers from the economic slowdown in Russia, and strengthening of the US dollar.
	Introduction of exchange rate restrictions.
	Completion of the 3rd natural gas pipeline to China (May).
	Iran is set to cut gas imports from Turkmenistan (7-8 bcm/yr).
	Completion of a large-scale chemical plant in the Mary region.
	Scaling back of the NATO presence from the TKM - AFG border (undermining border security).
	Subsidy reforms on gasoline and diesel.
2015	Devaluation of the official exchange rate from 2.85 to 3.5 manat per US dollar.
	Raised custom duties on food imports (effective from October).
	Continued subsidy reforms on electricity, gas, and water.
	Significant reduction of gas exports to Russia (from 10bcm/yr to 4bcm/yr).
	Sharp increase in food prices.
	Restrictions on car imports.
	Protracted low energy prices.

Year	Event
2016	Reported payment difficulties in several corporations. 10 year, US$ 30bn. goods for gas (barter) deal between TKM and Iran. Gazprom ceased imports from Turkmenistan. Concerns around TKM-AFG border security intensified. Continued drag from lower global energy prices. PMER started to diverge from the official rate. Tightening of exchange controls. Sanctions on Iran relieved. TKM to import engineering goods and services from Iran (US$ 2.5 bn). Continued spike in food inflation. Turkmenistan is pursuing about 1,900 major investment projects worth some US$ 48 billion.
2017	Gas exports to Iran stopped over payment dispute. Rising gas exports to China - with China becoming the sole market of TKM gas. Reports of `extreme shortage of hard currency` and tighter restrictions on imports. Completion of large-scale public investments (e.g., Ashgabat Airport, Asian Games - with an expected spending envelope of US$ 7.3 bn). Turkmenistan imported wheat - an indication of weak crop harvest. Similarly, cotton harvest is reported to be poor. Continued food price pressures. Reports of increased unemployment. Signs of reproachment between TKM and UZB. Differentiated hikes in the tariffs for electricity. Electricity exports started picking up.
2018	Raised regulated prices of utilities, public transport, and housing. Gasoline and diesel prices increased by 50 percent. Intensified exchange controls. Customs levies increased (e.g., on glass products). Recovery in global energy prices. Continued Chinese monopsony on Turkmen gas exports. International settlement on the status of the Caspian Sea - which could pave the way for major energy and connectivity projects. Largest foreign (Rus) telecom operator is forced out of business, which then filed an international arbitration case against TKM (US$ 750 m). Successful cotton harvesting campaign - with expected yield reaching one million tons. Completion of a large-scale chemical plant in the *Garabogaz* region.
2019	Attempts to compress imports by exchange controls. Resumption of gas exports to Russia (5.5 bcm/yr). Completion of large-scale gas-to-gasoline and gas chemicals plants.
2020	Global recession following the COVID-19 pandemic and a sharp decline in commodity prices. Significant decline in natural gas export volumes to China, Turkmenistan's largest trading partner. Introduction of 100 percent surrender requirement for export proceeds. Measures to curb public spending, amidst weak revenue performance. Continued scaling-back of public investments. Widening parallel market premium. Introduction of a loan-moratorium program to support borrowers hit by the pandemic. Rising inflation, reflecting cost-push pressures and higher food prices.

*Sources: IMF Article IV Staff Reports, Economist Intelligence Unit – Country Reports, The Daily News –
Turkmenistan, Chronicles of Turkmenistan, Official Website of Turkmenhimiya, Official Website of Gazprom.*

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