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Behind Schedule? Assessing Global Developments in the Provision of Economic Statistics

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Behind Schedule? Assessing Global Developments in the Provision of Economic Statistics

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ABSTRACT: We introduce a novel monthly index to measure developments in the provision of official economic statistics based on publicly disclosed observance records of subscribers to the IMF Data Standards Initiatives—the IMF's policy framework to promote the timely publication of key macroeconomic and financial data. While data is typically published in a timely manner, we document a notable shift toward longer delays since 2017. Persistent challenges in fiscal data dissemination, divergent trends in AEs and EMEs, and regional differences contribute to these dynamics. The measure also indicates that the public disclosure of economic data tends to get less timely for some economies during turbulent periods. Strained resources devoted to statistical services can help rationalize these dynamics. Through empirical applications, we demonstrate that these newly constructed indices contain predictive information for fiscal outcomes and economic downturns. Our findings demonstrate that while the Initiatives successfully promote the timely release of key macroeconomic and financial data, maintaining robust data dissemination requires sustained institutional capacity and adequate resource provision, especially during periods of distress when timely information is most crucial to support resolving macroeconomic imbalances and market disequilibria.

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1 Introduction

The provision of timely economic information provides the basis for effective decision-making and serves as a means to the general public to hold governments accountable (Adsera et al. 2003, Prat 2005, Besley 2006). Improvements in information provision and its publication rules can reduce asymmetries in markets as well as political processes (Stiglitz 2002). For example, timely available economic information allows households and firms to assess if and how their individual economic situation is affected by government action or other economic shocks (Duch & Stevenson 2008, Hollyer et al. 2014).

Hollyer et al. (2014) define transparency as *"the full flow of information within a polity"* (Hollyer et al. 2014, p. 413). In this paper, we focus on data transparency as a specific aspect of transparency, which is proxied by how effectively governments disseminate key macroeconomic and financial data. The importance of timely data releases is highlighted by Kerssenfischer & Schmeling (2024) who demonstrate that scheduled macroeconomic announcements significantly drive asset prices in major economies.[1]

This paper introduces a novel measure for how effectively subscribers to the IMF Data Standards Initiatives—a multilateral policy framework which encourages the voluntary publication of key macroeconomic and financial data—release such data. We construct a monthly global data timeliness index (DTI) for 78 countries from 2006-2023, leveraging the standardized monitoring of data dissemination through publicly available IMF Annual Observance Reports (AORs). Established in 1996, the IMF Data Standards Initiatives operate across three tiers: the Enhanced General Data Dissemination System (e-GDDS), the Special Data Dissemination Standard (SDDS), and SDDS Plus. While e-GDDS provides basic recommendations, SDDS and SDDS Plus subscribers[2] commit to adhere to commonly agreed upon data dissemination re-

[1] In the US, employment reports and general business outlooks importantly move asset prices, whereas monetary policy announcements are especially relevant in the euro area.

[2] This paper uses 'subscribers' and 'subscribe' of/to SDDS and 'adherents' and 'adhere' of/to SDDS Plus synonymously.

quirements and face more rigorous and publicly disclosed IMF monitoring. As of end-2023, a roughly equal number of advanced economies (AEs) and middle-income emerging market economies (EMEs) subscribe to the SDDS and SDDS Plus.[3]

Our analysis reveals several key stylized facts. First, while key macroeconomic and financial data is typically released in a timely manner, with levels remaining broadly unchanged between 2006 and 2016, we document a notable downward shift since around 2017. This marks a transition from a period of relative stability to one of increased volatility, lower average release efficiency, and longer lasting impacts of the large global shocks of recent years. The decline has been particularly pronounced among EMEs, resulting in a persistent gap between AEs and EMEs.

Second, data publication by statistical domain exhibits distinct patterns. While real sector data has been consistently released most timely, fiscal data dissemination faces persistent challenges, in part reflecting more complex inter-agency coordination in data production and publication (IMF 2022). This tends to be more challenging for relatively more decentralized economies. Resource constraints and technical considerations also seem to contribute to fiscal data dissemination having been disproportionally affected.

Third, some regional divergence can be observed since 2017. While European subscribers tend to release data more timely, Asian-Pacific subscribers closely track the global average. The Western Hemisphere shows the strongest improvement trajectory since 2018, contrasting with persistent declines in the Middle East and Central Asia.[4]

Fourth, data releases tend to get more delayed during periods of economic distress. This becomes evident across multiple episodes: the Global Financial Crisis (GFC), the European sovereign debt crisis, the COVID-19 pandemic, and the escalation of recent geopolitical tensions. AEs subscribers typically show greater resilience during these episodes, with quicker

[3]Currently, three low-income developing economies (DEs) subscribe to the SDDS as per IMF classification.

[4]To date, the share of subscribers from Sub-Saharan Africa remains relatively small compared to other regions. Before 2015, Mauritius and South Africa subscribed to the SDDS, and Namibia, Senegal, and the Seychelles joined since then.

recoveries and less severe declines, whereas especially recent shocks impacted timely data dissemination among EME subscribers more lastingly.

Rising fiscal challenges through elevated debt levels and limited fiscal policy space can help explain why official data releases may have gotten more delayed as they led to growing resource constraints on statistical agencies in both, AEs and EMEs. For EMEs this was further aggravated by decreasing donor funding for statistical capacity.

Our measure contributes to the literature through providing intuitive, performance-based, high-frequency monthly indicators that are based on publicly available records, comparable across a large set of economies, and consistent with the definition of data transparency put forward in the IMF Data Standards Initiatives. It also enables systematic analyses across time, statistical domains, and regions. We acknowledge that the *timely* dissemination of key macroeconomic and financial data covers a specific aspect of data quality and plan to include other dimensions in the measurement framework as soon as they become quantifiable.

The findings presented in this paper have important implications for further promotion of the timely publication of key macroeconomic and financial data, as well as for highlighting the need to dedicate adequate resources to statistical services, especially during times of economic crises. The IMF Data Standards Initiatives, launched after the 1994 Mexican crisis, aim to ensure timely access to critical economic data. Our findings reveal that these original challenges persist: decades later, data releases still tend to get increasingly delayed during times of distress, which highlights the ongoing importance of maintaining robust data transparency frameworks, particularly during those periods when timely information is most crucial to markets and policymakers to support resolving macroeconomic imbalances and market disequilibria. Further, while the AE-EME gap narrowed notably in 2023, differences between AEs and EMEs remain a cause for concern in this context.

We demonstrate the practical usefulness of our measure through empirical applications that focus on predictive relationships. On the back of panel-Granger causality tests, a temporal

sequence emerges where changes in public service spending help to predict changes in fiscal data timeliness, which in turn contains predictive content for changes in central government debt. We also find the DTIs to contain useful predictive information for economic downturns. Real and external DTIs are the most informative for business cycle recessions, whereas fiscal DTIs add the most predictive power for systemic crises, particularity for sovereign debt crises.

The plan for the remainder of this paper is as follows. Section 2 reviews the related literature and highlights the gap that we aim to address with our approach. Section 3 introduces the measurement framework. Section 4 documents key stylized facts and Section 5 explores potential explanations evolving around fiscal resources devoted to statistical services. Section 6 demonstrates the practical usefulness of the DTIs before section 7 concludes.

2 Reviewing Existing Approaches

Most existing studies provide point-in-time assessments of data transparency (see, e.g., Bellver & Kaufmann 2005, Hameed 2005, Islam 2006, Glennerster & Shin 2008) and focus on the quantity of disseminated data, without accounting for how timely this data was disseminated.[5]

Quantity-based Measures: Williams (2009) and Hollyer et al. (2014, 2024) construct time-series-based measures for many economies which are based on the coverage in the World Banks's (WB) World Development Indicators (WDIs) and the IMF's International Financial Statistics databases.[6] Both approaches provide objective metrics but do not factor in whether data releases were timely and, therefore, more or less useful for informing markets, policymakers, and the general public. Hollyer et al. (2024) acknowledge that delayed entries affect index construction, requiring sample truncation by many years and limiting the timely analysis of recent developments.

[5] Islam (2006) is a notable exception.

[6] More specifically, Hollyer et al. (2014, 2024) use a Bayesian item response (IRT) model in which data transparency is treated as a latent variable, indicating the tendency with which economies report data on WDIs. For details on their index as well as replications files, see https://hrvtransparency.org/.

Interpretation of Missing Data: The literature offers multiple rationales for data gaps that can be non-exclusive and economy-specific: missing data can be due to reluctance to disclose (see, e.g., De Mesquita et al. 2005, Williams 2009, Hollyer et al. 2015), lacking statistical capacity to collect and disseminate data (Stone 2008), or technical constraints.[7]

Timeliness-based Measures: Islam (2006) pioneered the timeliness-based measurement of data transparency. The author evaluates release lags of eleven economic variables published in WB and IMF databases or on official government websites (central banks, statistical offices, or ministries of finance) as of 2002, using judgment-based standards for dissemination practices.

World Bank Indicators: The WB's Statistical Capacity Indicators (SCIs) used information on timely reporting as one of their inputs[8] and are available for 43 of the 78 SDDS and SDDS Plus subscribers covered here on an annual basis. After having been retired in 2020, SCIs were replaced by Statistical Performance Indicators (SPIs) (Dang et al. 2023) which consider the subscription status to the respective tiers of the IMF Data Standards Initiatives but not how timely data was disseminated.[9] SPIs are available from 2016 onward.

With existing measures available at annual frequencies, the timely assessment of developments in the publication of official data remains limited. To address this, we provide a comprehensive novel monthly measure that incorporates the quantity of macroeconomic and financial data as well as the timeliness with which that data was released.

[7] To illustrate that these rationals can overlap, consider, for example, that resolving technical difficulties requires expertise, capacity, and the willingness to resolve. Further, a lack of capacity can be due to low political priority and, hence, unwillingness to expand statistical capacity.

[8] Beyond that, methodologies and data sources were also taken into account before calculating scores as an average of all three area scores on a scale of 0-100.

[9] SPIs are based on aspects of data use, data services, data products, data sources, and data infrastructure covered by 51 indicators.

3 Introducing the Measurement Framework

3.1 The IMF Data Standards Initiatives

The IMF Data Standards Initiatives promote data transparency through encouraging the voluntary publication of key macroeconomic and financial data (IMF 2022). The policy framework operates across three tiers: the Enhanced General Data Dissemination System (e-GDDS), the Special Data Dissemination Standard (SDDS), and the SDDS Plus. Almost all IMF members participate in one of the three tiers, depending on the level of their statistical capacity. The tiers get more stringent in terms of their dissemination recommendations and requirements and SDDS and SDDS Plus subscribers face more rigorous IMF monitoring.

Performance under the SDDS and SDDS Plus is publicly disclosed in Annual Observance Reports which evaluate: (i) data coverage and (ii) the timeliness of data releases against standard-implied requirements and release lags; (iii) the punctuality of data releases against self-committed, pre-announced data release commitments, (iv) data dissemination through a National Summary Data Page (NSDP), and (v) metadata certification.[10] AORs are publicly available on the IMF's Dissemination Standards Bulletin Board. Basing the indices on these records yields a measurement concept that is consistent with the definition of data transparency promoted under the IMF Data Standards Initiatives.

3.2 Source Data

AORs contain monthly information on data releases of real, fiscal, financial, and external sector data under two criteria: (i) *timeliness* as the difference between the end of a reference period and the date of data dissemination and (ii) *punctuality* as the difference between an economy's Advance Release Calendar (ARC) date and the date of data dissemination. The ARC guides the

[10]Note that AORs are administrative tools. The AOR tables used in this analysis provide comparable tracking of SDDS (Plus) compliance in accordance with the state and understanding of the policy framework at a certain time.

expectations of market participants and the public with respect to upcoming, pre-announced data releases. Note that under the punctuality criterion, both delays and early releases deviate from disciplined dissemination practices. Table 1 summarizes the covered data categories and associated timeliness requirements under the SDDS/SDDS Plus.

Table 1: SDDS and SDDS Plus Timeliness in Days

Real Sector		**Fiscal Sector**		**Financial Sector**		**External Sector**	
National accounts	90	General government operations:		Depository corporations survey	30	Balance of payments	90
Production index	45	· annual	180	Central bank survey	15	Official reserve assets	7
[Sectoral balance sheets	*120]*	*[· quarterly*	*365]*	*[Other financial corporations*		Reserves template	30
Employment	90	*[General government gross debt*	*120]*	*survey]*	*120*	Merchandise trade	60
Unemployment	90	Central government operations	30	*[Regulatory tier 1 capital to*		IIP	90
Wages/earnings	90	Central government debt	90	*risk-weighted assets*	*90]*	External debt	90
Consumer prices	30			*[NPL net of provisions to capital*	*90]*		
Producer prices	30			*[NPL to total gross loans*	*90]*		
				[NPL to total gross loans	*90]*		
				[Return on assets	*90]*		
				[Liquid assets to short-term			
				liabilities	*90]*		
				[Residential real estate prices	*90]*		
				[Debt securities	*120]*		

Notes: IIP - International investment position. NPL - nonperforming loans. *[]* indicate data categories additionally covered under SDDS Plus.

Our proposed measure leverages data dissemination through National Summary Data Pages as the standardized dissemination platform that all subscribers adhere to using. While subscribers may use multiple dissemination channels, NSDPs represent the only IMF-monitored platform across all subscribers, enabling international comparison.

Using AOR data from 78 subscribers, we construct a global composite data timeliness index as well as regional indices and indices per statistical domain. These indices then provide objective measures against international standards, are available on a monthly basis since 2006[11], can be regularly updated with each new AOR round, and allow for cross-country comparability.

3.3 Index Construction

The construction of the DTIs follows four core principles: (i) as *data source* publicly disclosed, regularly compiled records that are based on observable dissemination performance and enable

[11]The sixth review of the IMF's Data Standard Initiatives outlines staff's plans to publish assessments of observance under the SDDS for the year 2006 in early 2007 (IMF 2005).

cross-country comparison are used; (ii) on *flexibility* through accommodating varying subscription dates, handling different release frequencies (annual/quarterly/ monthly), and adapting to changing index composition as subscribers progress through the tiers, (iii) on *providing international scope* through ensuring broad geographic coverage and providing standardized measurement across jurisdictions, and (iv) on *consistent benchmarking* by relying on unchanged timeliness requirements, providing consistent measurement over time.

The information contained in tables 1 and 2 of an AOR is described in appendix A, which also provides an example for Swiss AOR tables for 2023. Based on this information, data timeliness/punctuality indices (DTIs/DPIs) for economy i, data category cat in period t are constructed as follows:

Timeliness:

$$DTI_{(i,cat,t)} = \begin{cases} \frac{StandardReleaseLag_{cat} + Delay_{(i,cat,t)}}{StandardReleaseLag_{cat}} \cdot 100 & \text{if } 0 \leq |Delay_{(i,cat,t)}| < StandardReleaseLag_{cat} \\ 0 & \text{if } |Delay_{(i,cat,t)}| \geq StandardReleaseLag_{cat}. \end{cases} \quad (1)$$

Punctuality:

$$DPI_{(i,cat,t)} = \begin{cases} \frac{StandardReleaseLag_{cat} - |Deviation_{(i,cat,t)}|}{StandardReleaseLag_{cat}} \cdot 100 & \text{if } 0 \leq |Deviation_{(i,cat,t)}| < StandardReleaseLag_{cat} \\ 0 & \text{if } |Deviation_{(i,cat,t)}| \geq StandardReleaseLag_{cat}. \end{cases} \quad (2)$$

$StandardReleaseLag_{cat}$ as specified in table 1 refers to the standard-implied release lag per SDDS/ SDDS Plus data category. This relative measurement enables cross-category comparability and interpretation in percentage terms. For the DTIs, $Delay_{(i,cat,t)}$ reflects actual delays in days, while it reflects deviations from schedule for the DPIs. For punctuality, absolute deviations are considered to capture both early and late releases.[12]

[12]Note that the timeliness-based DTI caps reporting performance at 100 percent as it penalties delays but does not reward early reporting, which reflects the timeliness versus accuracy trade-off incorporated in the standard-implied release lags.

The scoring framework allows for the following intuitive interpretation: no delays, i.e., timely and schedule-adhering releases, are associated with a perfect 100 percent score. For delays between up to an extra standard-implied reference period, the indices decrease linearly to 0 percent.[13] Delays beyond two times the standard-implied release lag are associated with releases past the due date for the next data release. They are, hence, no longer considered to be timely or punctual and are associated with a 0 percent score. This interpretation aligns with the IMF Executive Board's Decision Amendments for SDDS, summarized in IMF (1996).[14] Doing so also has a very useful implication for aligning the absolute statements of 'X' for not disseminated and 'O' for missing ARC entries with the numerical entries. Instead of having to interpret 'X' and 'O' strongly as data that was never disseminated through the NSDP, the assigned score then corresponds to late dissemination past the next release date.

3.4 Aggregation to Global Indices

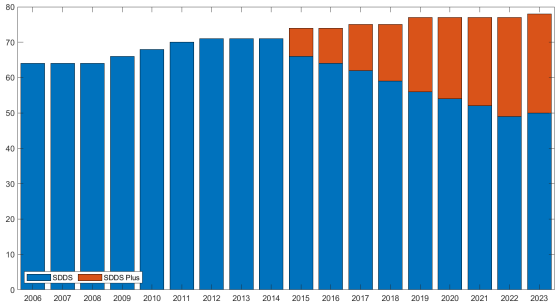
We construct composite indices as well as aggregates for the four statistical domains (real, fiscal, financial, and external data indices) and regional aggregates (covering the five main regions considered by the IMF: Sub-Saharan Africa (AFR), Asia/Pacific (APD), Europe (EUR), Middle East/Central Asia (MCD), and the Western Hemisphere (WHD)) based on cross-country means. All subscribers and data categories contribute with equal weight. With an increasing number of subscriptions, the aggregates are based on an increasing number of economies over time. Potential sensitivity to a changing set of subscribers is investigated in appendix E. Figure 1 displays

[13] Results on the aggregate are almost identical if alternative penalty functions are considered. Considering exponential functions that either punish longer or shorter delays more compared to the linear benchmark function yield almost indistinguishable results on the aggregate. We, thus, opt for the function that offers the most straightforward interpretation. Further, one could consider penalizing repeated non-dissemination or missing ARC dates with increasing intensity. We refrain from such a penalization scheme and opt for a more lenient approach, equivalent to putting all weight on a subscriber's current performance without putting additional weight on their past dissemination practices.

[14] Therein, it is noted that flexibility for periodicity and timeliness that subscribers can draw on a limited number of data categories *"is not open-ended. The extra allowance for compilation or dissemination under the flexibility options, [...], is usually not to exceed one reference period, and the data are to be disseminated no later than the next due date."* (IMF 1996, p. 7).

the evolution of subscription to SDDS/SDDS Plus since 2006. As of end-2023, 78 economies have subscribed to SDDS and SDDS Plus and are, thus, considered in aggregation. Details on the subscribing economies such as their subscription status are summarized in appendix B.

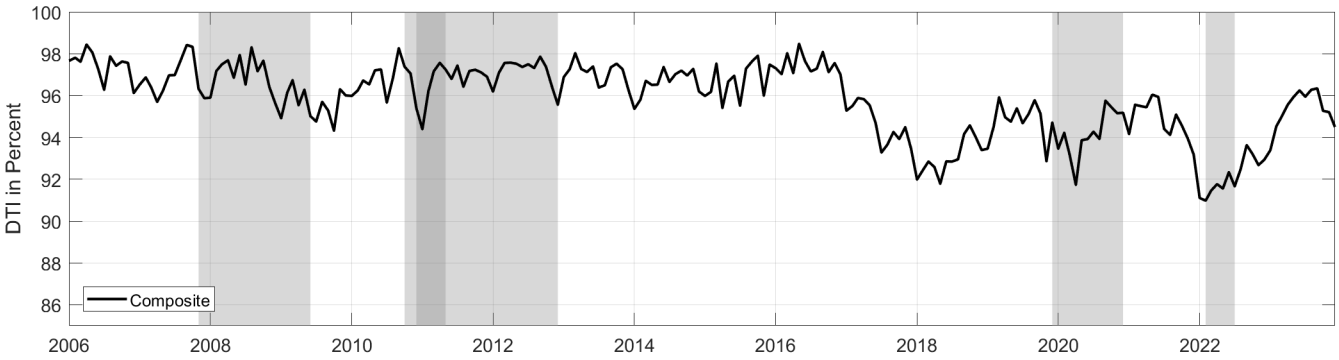
Figure 1: Number of SDDS and SDDS Plus Subscribers/Adherents



4 Stylized Facts

Figure 2 shows the results for the global composite AOR-based data timeliness index.[15]

Figure 2: Global Data Timeliness Index



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. The composite global DTI is based on the mean of the subscriber-specific indices. All data categories and subscribers contribute with equal weight as their information becomes available and subscription takes effect. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

Global DTI levels are generally high, ranging on average across subscribers between 92 and 99 percent from 2006 to 2023. That is SDDS/SDDS Plus subscribers have been publishing the required data consistently with over 90 percent timeliness, which indicates that the IMF Data

[15]The punctuality-based global DPI is shown in appendix C.

Standards Initiatives provide an effective framework for subscribers to release key macroeconomic and financial data in a timely manner. These generally high levels likely reflect the relatively mature statistical systems of SDDS/SDDS Plus subscribers that are based on established institutionalized statistical capacity and advanced reporting capabilities.

Second, the index, yet, declined over time. While the first ten years of the covered sample period were characterized by high and relatively stable DTI levels, the level dropped noticeably and persistently thereafter. Since 2017, the index is also exposed to higher volatility. More recently, it recovered though without fully recovering to pre-2017 levels.[16]

Third, beyond the overall downward tendency, the global DTI tends to comove with major global disruptions as it decreases and is exposed to increased volatility during turbulent times and periods of (economic) crises. A relatively mild decline can be observed during the GFC, followed by subsequent dips during the Arab Spring and the European sovereign debt crisis. COVID-19 induced a sharp decline followed by a V-shaped recovery. During 2022, a distinct drop can be observed around Russia's invasion of Ukraine. Further, since the pandemic, an increase in comovement with global economic conditions as introduced in Baumeister et al. (2022) can be observed, suggesting strengthened linkages between governments' efficiency to release official data and the state of the global economy. Before the pandemic, no such or negative comovement prevailed, which is more in line with expectations that both are unlikely to interact.[17]

Fourth, recovery patterns seem to have changed. Before 2017, recoveries after crisis events were quick. After 2017, recoveries became more sluggish and remained incomplete with respect to previously higher DTI levels. Despite the impact of successive crises events, the global

[16] In light of the evolving number of subscribers considered in the sample over time, section E.2 shows that these insights are robust to composition effects.

[17] Baumeister et al. (2022) derive a measure for global economic conditions from a forecasting model for real oil prices and global petroleum consumption that includes world industrial production, geopolitical risk, developments in transportation, oil price uncertainty, and weather-related indicators. To gauge comovement in both measures, two-year rolling correlations based on the Hamilton-filtered versions (Hamilton 2018) of both series are computed. While these correlations are close to zero or negative until the pandemic, they increased since 2020 up to about 0.75 by mid-2023.

DTI did not drop below 90 percent, on average across subscribers, suggesting some resilience and post-crisis periods often show temporary improvements. However, the long-term trend suggests that these improvements are becoming harder to maintain.

To solidify these observations on changed recovery patterns since 2017, further insights on trend and cyclical movements in the global DTI as derived from Hamilton-type (Hamilton 2018) trend-cycle decompositions are provided in appendix D. While the extracted trend estimates decline especially after 2017, gap estimates reflecting the difference between index levels and the trend estimates widened in recent years. Gaps became more persistent as they did not revert or close as quickly as earlier in the sample.

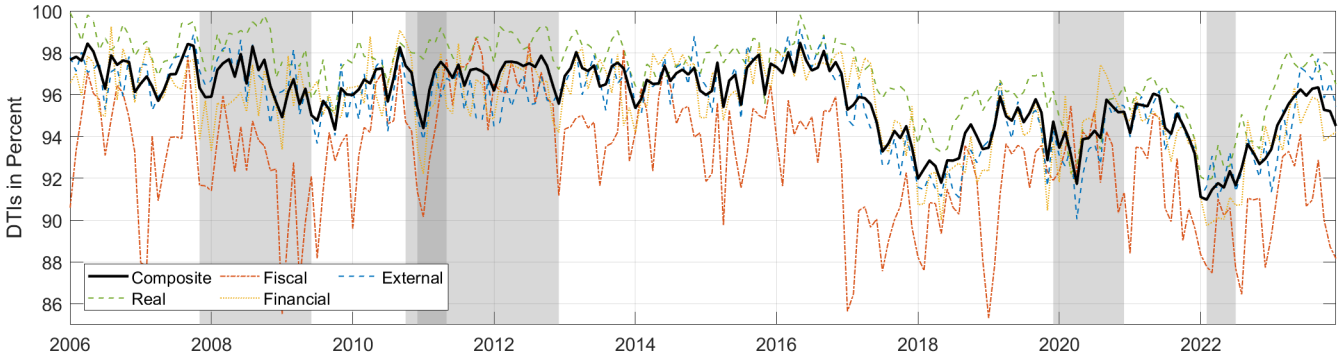
Launched after the 1994 Mexican crisis, the IMF Data Standards Initiatives aimed at ensuring timely access to critical economic data to *"prevent the hidden accumulation of imbalances and disequilibria"* (IMF 2022, p. 5) while promoting disciplined data dissemination to inform markets, policymakers, and the public to support resolving such macroeconomic imbalances and market disequilibria. The findings presented here suggest that these original challenges persist since the global DTI still tends to decline during times of global economic distress. This highlights that the original mission of the Initiatives to keep the spotlight on the importance of timely data dissemination and data transparency remains highly relevant.

4.1 Data Timeliness Indices by Statistical Domain

Next, we extend the list of stylized facts by investigating differences among the four statistical domains—real, fiscal, financial, and external sector data—in greater detail. Figure 3 shows the composite global DTI, alongside subindices for the statistical domains, derived as means of the respective data categories per domain.

While the overall decline can be observed in all subindices, important differences emerge. Real sector data are released most timely. In terms of dynamics, the real, external, and financial subindices tend to track each other closely. Yet, the dips in timely financial data dissemination

Figure 3: Composite Global DTI and DTIs by Statistical Domain



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. The composite DTI is shown, alongside the subindices for the four statistical domains: real, fiscal, financial, and external. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

tend to be larger during crises periods associated with financial distress such as the GFC and the European sovereign debt crisis. Fiscal data tends to be reported less timely and the deterioration in timeliness is especially pronounced since 2017.[18] This also resonates with existing gaps and challenges in debt data collection and dissemination (IMF 2023). Moreover, the differences among subindices have widened over time.

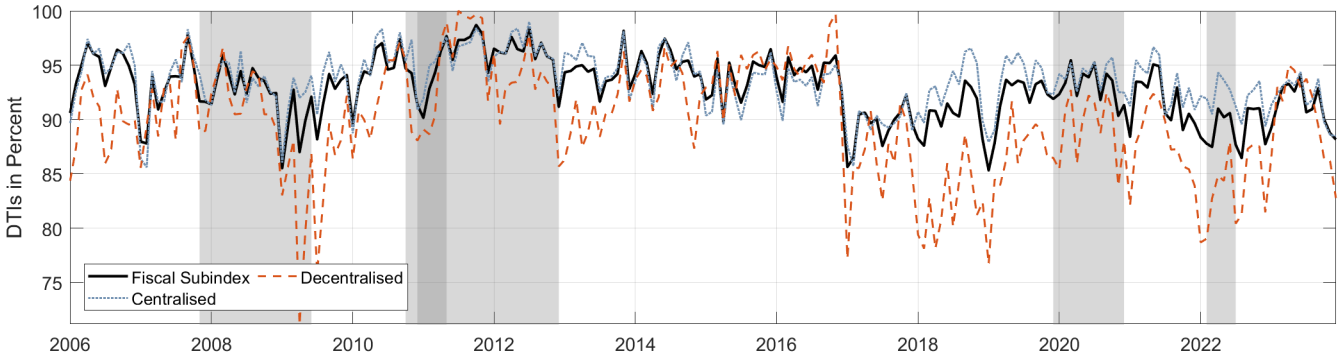
Can the degree of fiscal centralization shed light on this? Relatively higher decentralization likely requires a higher degree of interagency coordination across different levels of government to compile and disseminate fiscal data. To gauge this, figure 4 compares the performance of economies with a relatively large subnational government sector (decentralized economies) and those with a comparatively large central government sector (centralized economies). Economies are grouped according to their tax revenue decentralization as a share of general government from the IMF's Fiscal Decentralization Dataset.[19]

Decentralization is associated with longer delays in fiscal data dissemination. On average,

[18]Challenges in fiscal data dissemination are further reflected by the number of flexibility options drawn by subscribers. The standards allow drawing a limited number of flexibility options on the timeliness and periodicity of the required data categories (IMF 2013). Flexibility options for central and general government operations rank among the top three (IMF 2022).

[19]Roughly 81 percent of SDDS/SDDS Plus subscribers report fiscal data to the IMF's GFS for at least one level of subnational government. We follow the threshold choice of 0.29 percent of tax revenue decentralization as share of general government as on the webpage to indicate a relatively high level of decentralization of the government sector. Then, as of 2020 (or the latest reported indicator value), 14 economies are classified as relatively decentralized, while the remaining 49 economies are grouped as relatively centralized.

Figure 4: Composite Global DTI and DTIs by Fiscal (De)centralization



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. The fiscal DTI is shown, alongside indices accounting for economies with relatively larger subnational government sectors (decentralized) and relatively larger government sectors (centralized). Subindices are computed as means across the respective economy groups. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

this group is characterized by lower fiscal DTI values compared to the group of relatively more centralized economies in the sample. This is particularly relevant since fiscal data transparency is critical in the light of growing evidence for tangible economic benefits of enhanced fiscal (data) transparency—especially for EMEs and DEs. Greater fiscal transparency has been found to be associated with better credit ratings and fiscal discipline (Hameed 2005) as well as with lower sovereign financing costs for EMEs (Cady 2005, Cady & Pellechio 2006, Glennerster & Shin 2008, Moretti 2011, Choi & Hashimoto 2018, Copelovitch et al. 2018, Gonzalez-Garcia 2024) and AEs (Bernoth & Wolff 2008, Arbatli & Escolano 2015, Copelovitch et al. 2018).

4.2 Data Timeliness Indices by Economy Groupings

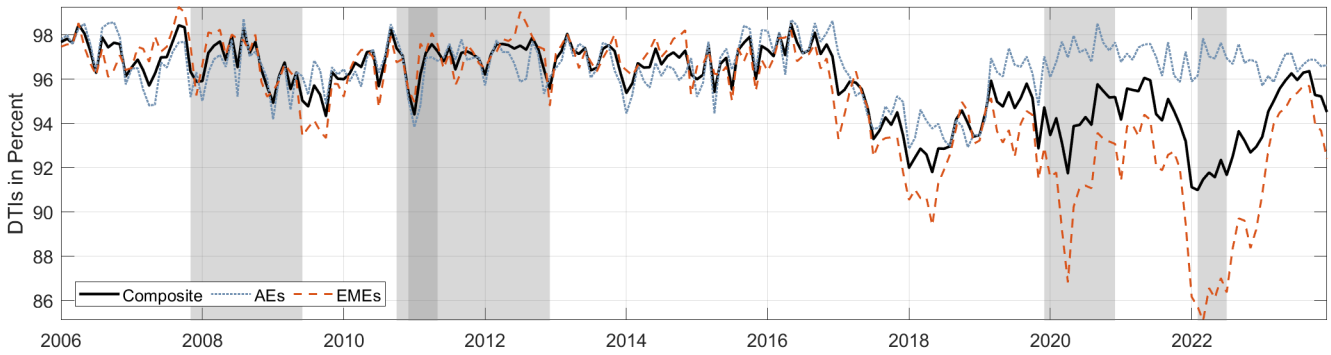
This section investigates differences by income level and by region.[20]

Figure 5 reveals why the composite DTI did not recover to pre-2017 levels. This is driven by divergent trends in AEs and EMEs. While there was little difference between the two groups before 2017, a persistent gap opened up since then.[21] During and after the pandemic, reporting performance among AEs showed greater resilience and recovered to pre-2017 levels, while

[20] See annex B for details on economy groupings.

[21] Before, EMEs outperformed AEs during some periods, e.g. during episodes of the European sovereign debt crisis.

Figure 5: DTIs by Economy Groupings: Advanced- and Emerging Middle-Income Economies



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. Classifications follow IMF classifications. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

Covid-19 and the recent episode of increased geopolitical tensions impacted dissemination efficiency more lastingly in EMEs. The persistent gap between the two groups kept the composite index on a lower level. Yet, over the course of 2023, it narrowed considerably.[22]

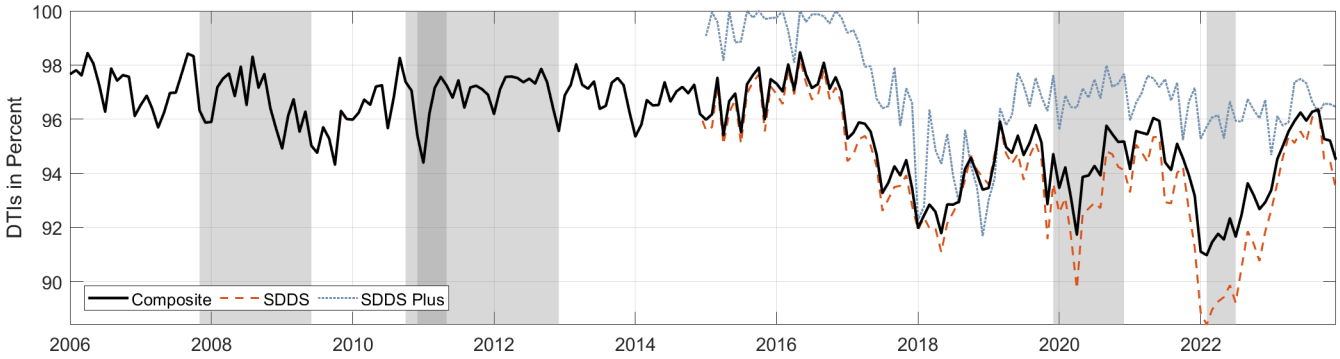
If the SDDS/SDDS Plus slit is considered instead, similar patterns as before emerge, with the difference that SDDS Plus reporting performance started on an even higher level in 2015.[23] Yet, the pronounced decline during 2017/18 can also be documented for SDDS Plus subscribers, with subsequent settling on a lower level for the group.

Similarly, regional patterns exhibit increasing divergence since 2017. Figure 7 shows DTIs based on subscribers from each respective region. While comovements with the global DTI are high and more homogeneous across regions pre-2017, regional divergence increases thereafter. The pandemic impacted all regions, but with varying severity. While EUR subscribers showed the most resilient performance on average, the average AFR, MCD, and WHD subscriber seems to have been more vulnerable to shocks, especially during the pandemic. The average APD

[22]These insights are robust to alternatively considering the WB's classification of high- and middle-income countries, which suggests a slightly different composition across both groups.

[23]Considering the SDDS/SDDS Plus split instead yields the same qualitative insights. While SDDS Plus was established in 2012, the first eight countries adhered in 2015 (IMF 2022). As of end-2023, 29 economies adhere to SDDS Plus of which 24 are AEs. Hence, the SDDS/SDDS Plus economy-split is slightly different, but remains still mainly along the AEs and EMEs classification. For the SDDS/SDDS Plus split, we follow a dynamic approach for composing the groups according to the month when subscription to the respective tier of the IMF Data Standards Initiatives took effect. The approach for the AEs/EMEs split is static, following IMF classification as of 2024.

Figure 6: DTIs by Economy Groupings: SDDS Subscribers and SDDS Plus Adherents



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

subscriber tracks the composite index closely. Volatility is the highest for the group of AFR subscribers, subsuming the fewest subscribers in the sample.[24] MCD subscribers showed, on average, the most persistent decline, which started a little earlier than in other regions around 2015, whereas the most relative improvements since 2018 can be observed for WHD subscribers.

Appendix E investigates potential composition effects in detail. While the mean-based DTIs are importantly driven by weak performances at the bottom of the monthly distributions, the key stylized facts remain robust to alternative index compositions and extending the set of economies with new subscribers does not materially drive global DTI dynamics.

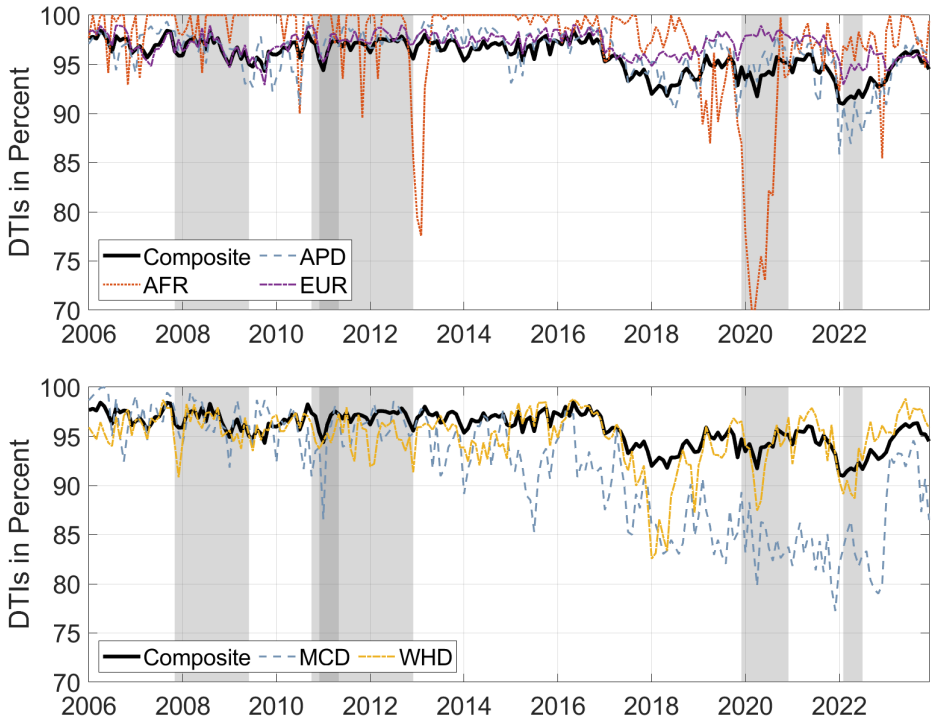
5 Tighter Fiscal Stances and Constrained Resources

What else could then explain DTI dynamics? As other public services, the timely publication of aggregate macroeconomic and financial data requires an appropriate provision of statistical services, which requires dedicated resources. Thus, fiscal resources devoted to statistical services could help explain DTI developments.

Looking at fiscal resources, own and donor-funded, it can be observed that the overall budgetary envelope has shrunk, with adverse implications for statistical services. This is further

[24] Yet, note that this regional DTI is usually very high, often at or close to 100 percent.

Figure 7: DTIs by Economy Groupings: Regional Differences



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

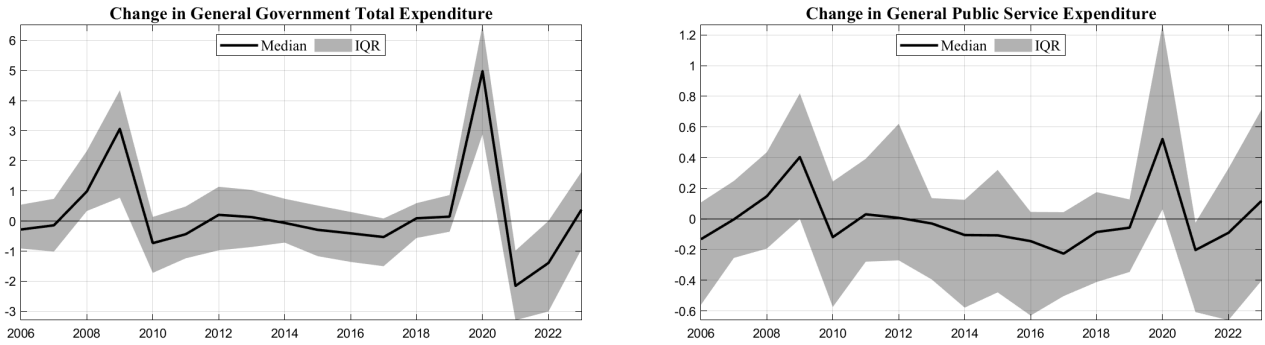
supported by growing evidence of underfunding of national statistical offices (Grant 2012, Hartman et al. 2014, The Globe and Mail 2014, West 2017, Groshen 2021, UKSA 2022, Campbell 2023, American Statistical Association 2024, The Economist 2025).

To gauge developments in overall own resources, World Economic Outlook (WEO)-based nominal changes in total government expenditure are used.[25] Additionally, nominal changes in stances for general public service expenditure, which include spending on overall planning and statistical services are considered. Both are considered in terms of GDP. Due to a lack of data on the functional classification of expenditure and data on resources specifically devoted to statistical services, general public service expenditure remains an imperfect proxy. Information on general public service expenditures comes from the IMF's GFS database as an unbalanced panel and is considered from 2005 to 2022.[26]

[25]Data on total government expenditure comes from the IMF's WEO April 2024 database. Values for 2023 are partially staff estimates.

[26]Since no detailed information in the Expenditure by Function of Government Functional Expenditures (CO-

Figure 8: Nominal Changes in Total and General Public Service Expenditures



Sources and notes: Information on general government total expenditure as obtained from the IMF's WEO April 2024 database and information on general services expenditure from the IMF's Government Finance Statistics database. IQR: interquartile ranges of cross-country nominal growth rates in general government total expenditure and general public service expenditures, respectively.

While general government total and general public service expenditures grew during the GFC and the Covid-19 pandemic across economies to cushion the severely adverse economic impacts of these large global shocks, both shrank during the years in between to consolidate and rebuild buffers. Both shrank the most by 2016/17, suggesting increasingly constrained resources prior to the drop in the DTI in 2017/18.

Second, figure 9 illustrates that donor funding for statistical capacity building directed toward EMEs declined substantially between 2013 and 2017, especially for some high-recipient economies.[27] The notable bounce-back in 2022 coincides with a narrowing gap between AE- and EME-DTIs after 2022.

Since 2017, EMEs' DTIs decreased (see figure 5) and recovery to pre-2017 levels remained incomplete. The decrease in donor funding did not only affect recipients, but also indicates lower prioritization for statistical capacity building among donors themselves, which can compromise reaching the UN SDGs (OECD 2022).[28]

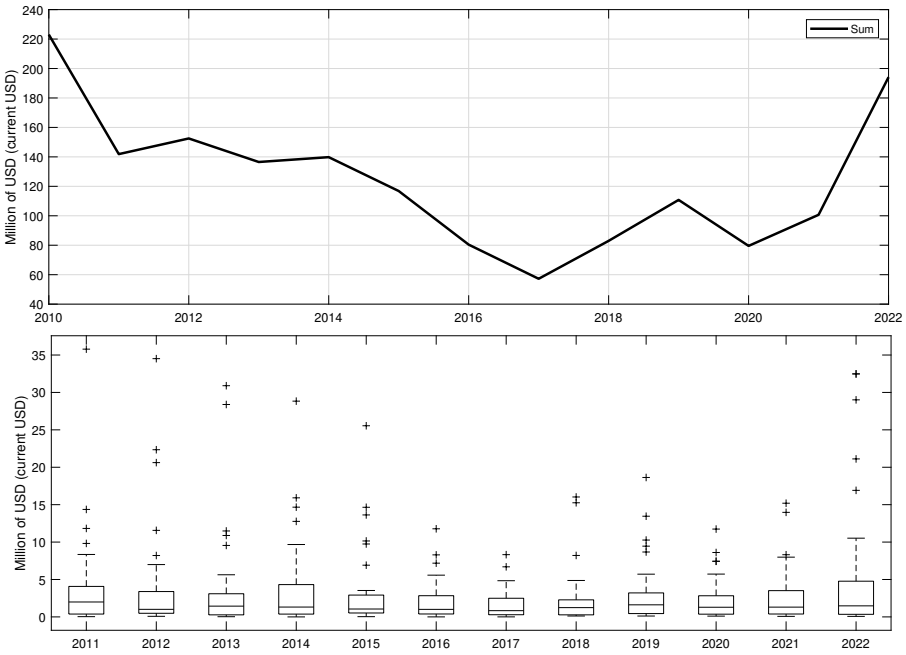
Third, evidence for shrinking inflation-adjusted budgets for statistical offices and agencies across economies is growing (Grant 2012, UNSD 2013, The Globe and Mail 2014, West 2017,

FOG) is available during these years for Colombia, Morocco, Mexico, North Macedonia, Peru, Saudi Arabia, Senegal, and Uruguay, these subscribers are not included in the calculations.

[27] The indicator captures donor funding from OECD donors. Data is available for 38 of the 78 economies covered in this study and predominantly covers the EMEs of the sample.

[28] Redirection away from EME to DE destinations largely explains the drop in funding going toward EMEs.

Figure 9: Donor Funding to Strengthen Statistical Capacity



Sources and notes: SDG indicator: *"dollar value of all resources made available to strengthen statistical capacity in developing countries"* as a sum of available funds to precipitant economies on the left and in box plot representation on the right.

Groshen 2021, UKSA 2022, Campbell 2023, The Economist 2025). Such low prioritization tendencies may constrain necessary modernization and innovation efforts in the age of data science and AI (American Statistical Association 2024), which are needed to maintain the quality of official statistics.

6 Empirical Applications

In this section, we investigate potential predictive relationships between the DTIs and public finance outcomes as well as early warning properties for economic downturns. The insights obtained through these exercises are an initial step in investigating the economic information of our measures. We leave further explorations and the identification of (dynamic) causal effects to future research.

6.1 Fiscal DTIs and Public Finance Outcomes

Throughout the paper, fiscal data dissemination has been a recurring theme. To study possible implications further, we investigate the relationship between the fiscal DTIs and public finance outcomes next. This is done on the back of two-variable panel VARs and Granger causality tests (Granger 1969, Lopez & Weber 2017). In a first specification, year-on-year changes of the economy-level fiscal DTIs are paired with changes in general public service expenditures to gauge if a variable contains useful predictive information for the respective other variable. In a second VAR specification, year-on-year changes of the economy-level fiscal DTIs are paired with changes in central government debt (CGD).[29]

A temporal sequence shapes with changes in public service spending containing predictive information for how efficiently governments release fiscal data, which in turn contains predictive information for changes in CGD.[30] More specifically, we find past changes in general public service spending to help forecast fiscal DTIs while we do not find evidence for the reverse to hold. The third lag of changes in general public service spending adds the most information and reflects a positive correlation between general public service spending three years ago and changes in fiscal data dissemination in period t. This suggests that the timely dissemination of fiscal data improves (decreases) with a lag after general public service spending is increased (decreased). We find this predictive relationship to be significant only with respect to fiscal data dissemination, not for the other sub-DTIs or the composite DTI. Regarding the second model specification, we find changes in past fiscal DTIs to improve CGD growth forecasts.[31] This can be observed for all sub-DTIs and the composite DTI. Here, we also find the coefficient signs to be predominantly intuitively negative, suggesting that improving data release efficiency helps

[29] General Government Debt (GGD) is alternatively also considered. Results are qualitatively comparable, but GGD data is available for fewer subscribers.

[30] While this study establishes predictive relationships, further research using structural identification strategies could shed more light on the directions of causality.

[31] The Granger causality Walt test statistic rejects the null hypothesis of no Granger causality at the 1% level. VAR coefficients in both specifications, fiscal DTI-CGD and the fiscal DTI-public service spending, are estimated to be significant up to the first three own lags.

to forecast future decreases in CGD, vice versa.[32]

6.2 Do DTIs have Early Warning Properties?

Diving deeper into potential predictive content of the DTIs, we are also interested in their early warning properties for economic downturns. The disciplined publication of key macroeconomic and financial data shall inform the public, markets, and the international community in a timely manner to facilitate the early resolution of macroeconomic imbalances and market disequilibria (IMF 2022). If releases are, however, increasingly delayed, this could be a reflection of deeper structural frictions, such as decreasing government efficiency or misallocation of government resources, that could potentially go along with economic turmoil (ahead).

We test this hypothesis on the back of Receiver Operating Characteristic (ROC) curves, which provide a standard tool to evaluate binary classification ability, in the spirit of the approach taken in Schularick & Taylor (2012). ROC statistics are derived from panel logit models. As classifiers, economy-specific business cycle recessions are derived from the well-established Bry-Bochan algorithm (Bry & Boschan 1971) on real GDP series from the IMF's WEO April 2024 database for the sample from 2006Q2-2023Q4.[33] Beyond business cycle recessions, we are interested in any predictive content for systemic crises (Laeven & Valencia 2018, 2020, Nguyen et al. 2022), which are typically more costly in terms of output losses (see, e.g. Kaminsky & Reinhart 1999, Cerra & Saxena 2008, Reinhart & Rogoff 2009, Jordà et al. 2011, Schularick & Taylor 2012, Jordà et al. 2013, Greenwood et al. 2022) and associated with more structural origins. Aiming to prevent systemic crises from occurring is, thus, very desirable from a policy perspective.

In the baseline specification, quarterly economy-specific composite DTIs serve as the main explanatory variable. Four years of lagged DTI-growth are considered. With systemic crises being rare events, we consider all types of systemic crises (banking, currency, and sovereign debt

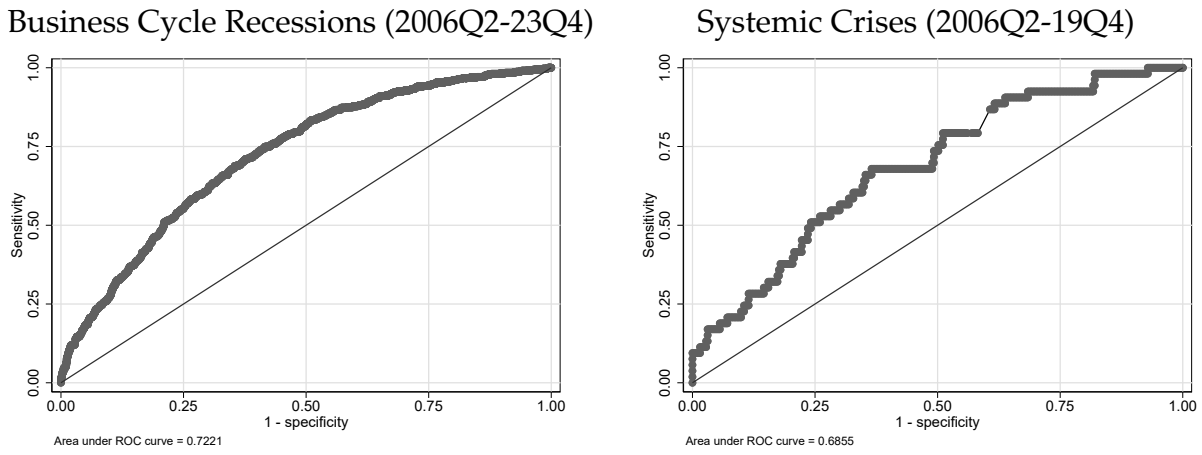
[32] Detailed quantitative results are available upon request.

[33] For the majority of economies, quarterly series are available and turning points are derived from samples starting in 2000Q1. If only annual series are available, these are interpolated using cubic splines on 2005-2023 samples. This is done for EGY, KGZ, LKA, MKD, MNG, MUS, NAM, SAU, SEN, SLV, SYC, URY, and WBG.

crises) jointly at first, but differentiate between types later. The business cycle recession specification runs until 2023Q4, while the systemic crises specification ends in 2019 due to limited availability of systemic crises observations across economies thereafter.[34]

Figure 10 shows results for the baseline specification per crisis type. ROC curves show the true positive rate (TP), or sensitivity, against the false positive rate (FP), or (1-specificity), for all thresholds. The 45-degree diagonal is associated with a random ("coin toss") classifier. Informative indicators deliver $TP > FP$ and a ROC curve above the 45-degree diagonal. For both, the business-cycle- and the systemic-crises-exercises, ROC curves lay above the diagonal and the associated AUROC (area under the ROC) statistics are larger than 0.5 with 0.72 and 0.70, respectively, which suggests that economy-specific DTIs contain useful predictive information for economic developments.

Figure 10: Baseline ROC Curves for Business Cycle Recessions and Systemic Crises



Notes: Business cycle recessions are derived as economy-specific Bry-Bochan-type recessions (Bry & Boschan 1971). Systemic crises come from Laeven & Valencia's (2020) updated database, which is amended by Nguyen et al. (2022) for the years 2018-19, and all types of systemic crises recorded therein are considered jointly. Four years of lagged variables, i.e., 16 quarters, are included for the explanatory DTI-variable.

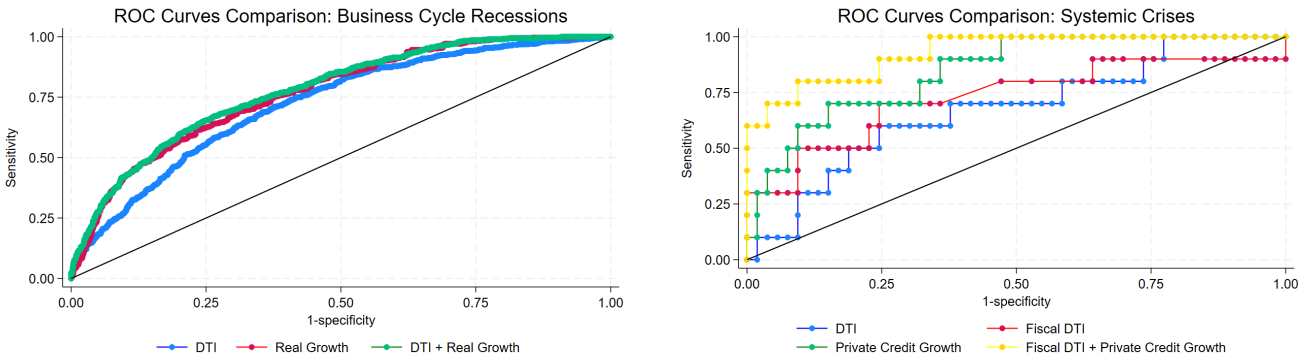
Appendix F provides detailed results and robustness checks. The evidence provided therein, i.e., shows that improving data dissemination is associated with decreasing odds for a business cycle recession to occur. Further, different sub-DTIs contain distinct predictive information. Real and external DTIs are more informative for business cycle recessions, whereas fiscal DTIs

[34]Data on systemic crises is available until 2017 in Laeven & Valencia (2020). For the years 2018-19, this database is amended by Nguyen et al. (2022) and information on systemic crises is available on an annual basis. In quarterly specifications, it is assumed that a systemic crises was active in all quarters of a respective year.

show the strongest predictive ability for systemic crises, especially sovereign debt crises. While adding macroeconomic variables, especially credit- and debt-related information increases the predictive ability in line with Schularick & Taylor (2012), the main insight that DTIs contain useful predictive information for economic developments and can add additional predictive power to model specifications remains robust to alternative model specifications.

To put some of these insights into perspective, figure 11 compares ROC curves across different specifications. While the composite DTI does not add much predictive power in the business cycle specification when lags of real growth are considered, it is noteworthy that including only lagged DTIs is almost as informative as including lagged real growth at many thresholds. For some thresholds, a model that includes both, lagged DTIs and real growth, shows marginal gains. In systemic crises specifications, private credit growth is usually identified as the single best early warning indicator (see, e.g., Schularick & Taylor 2012, among many others). We find the same here, with the private credit growth specification dominating models that include lags of the composite or the fiscal DTIs. But extending the private credit growth specification by including lags of the fiscal DTIs improves the model's early warning properties along many thresholds. This is noteworthy and likely reflects the fiscal DTIs' usefulness to indicate sovereign debt crises.

Figure 11: ROC Curve Comparisons



Notes: Business cycle recessions are derived as economy-specific Bry-Bochan-type recessions (Bry & Boschan 1971). Systemic crises come from Laeven & Valencia's (2020) updated database, which is amended by Nguyen et al. (2022) for the years 2018-19, and all types of systemic crises recorded therein are considered jointly. Four years of lagged variables, i.e., 16 quarters, are included for the explanatory DTI-variable.

7 Conclusion

This paper introduces a novel high-frequency monthly measure for governments' effectiveness to publish official statistics that is based on publicly disclosed observance records of subscribers to the IMF Data Standards Initiatives and is available since 2006.

Several stylized facts emerge: first, while official data has typically been released in a timely manner, we document a notable shift toward longer delays since 2017, which is particularly pronounced among EMEs. This led to a widening gap in the timely dissemination of key macroeconomic and financial data between AEs and EMEs. Second, while real sector data is consistently published more timely than other data, fiscal data dissemination faces persistent challenges. More coordination-intense government decentralization has, on average, been associated with longer delays in recent years. Third, regional patterns diverge more since 2017 and fourth, the timely dissemination of official data tends to decrease during episodes of global distress.

Constrained fiscal resources devoted to statistical services can help explain these developments. The findings presented in this study bear important implications as they highlight the importance of maintaining robust data transparency frameworks. The IMF Data Standard Initiatives provide an effective framework to do so if subscribers comply. As demonstrated through the empirical applications, decreasing compliance can be accompanied with other challenges related to, for example, fiscal outcomes or economic downturns. Future research will hopefully shed even more light into some of these aspects.

With official data releases tending to get increasingly delayed during times of economic distress, resilient compliance matters to provide information when it is most crucially needed to help resolve macroeconomic imbalances and market disequilibria. This, however, requires sustained institutional capacity and sufficient resources. With growing evidence for strained resources for statistics in both, AEs and EMEs, these have been under pressure. Overall, this study demonstrates that the initial mission of the IMF Data Standards Initiatives continues to remain highly relevant.

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A Details and Examples of AOR Tables 1 and 2

This appendix illustrates Tables 1 and 2 in an AOR, showing those from the Swiss 2023 AOR. Generally, AOR Tables 1 and 2 contain the following specific information: 'check marks' reflect timely or punctual data releases through the NSDP, i.e., a delay of 0 days. Delays are recorded as negative entries measured in days. 'X's indicate entries for which data was not disseminated through the NSDP and 'O's reflect missing ARC dates. Both, Xs and Os are associated with a 0 percent timely or punctual data release. The reports can further indicate 'NYD' when data is not yet disseminated or 'P' when a release is pending. Since these two classifications are relatively rare and often occur toward the end of the reference period, they are treated as if data dissemination had been timely or punctually in index construction. Being lenient in this regard avoids a systematically different treatment of observations toward the end of a year due to the timing of AOR compilation in the first of half of the following year.

Table 1. Switzerland, 2023: Timeliness Against SDDS Plus Requirements

Unshaded cells reflect SDDS Plus prescribed periodicity; entries in shaded cells reflect cases where SDDS Plus prescribed periodicity is exceeded or where flexibility options are used.
√ – SDDS Plus requirement met; × – data were not disseminated; P – pending release; negative numeric entry – number of days dissemination was later than timeliness requirement; S – next to an observation indicates release related to semi-annual data.

Data Category	National Periodicity	Prescribed Release Lag	Reference Period																
			Prev yr	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Jul	Aug	Sep	Q3	Oct	Nov	Dec	Q4
Real Sector																			
National accounts	Q	1Q					√				√				√				√
Production index	Q -PF-TF	6W					√				√				√				√
Sectoral stocks of financial assets and liabilities	Q	4M					√				√				√				√
Labor market: Employment	Q	1Q					√				√				√				√
Labor market: Unemployment	M *	1Q		√	√	√		√	√	√		√	√	√		√	√	√	
Labor market: Wages/Earnings	Q	1Q					√				√				√				×
Price index: Consumer prices	M	1M		√	√	√		√	√	√		√	√	√		√	√	√	
Price index: Producer prices	M	1M		√	√	√		√	√	√		√	√	√		√	√	√	
Fiscal Sector																			
General Government Operations	Q	12M					√				√				√				√
General government gross debt	Q	4M					√				√				√				√
Central government operations	M	1M		-31	√	√		√	√	√		√	√	-30		√	√	-29	
Central government debt	Q	1Q					√				√				√				√
Financial Sector																			
Depository corporations survey	M	1M		√	√	√		√	√	√		√	√	√		√	√	√	
Central bank survey	M	2W		√	√	√		√	√	√		√	√	√		√	√	√	
Other financial corporations survey	Q	4M					√				√				√				√
Regulatory Tier 1 capital to risk-weighted assets	Q	1Q					√				√				√				√
Regulatory Tier 1 capital to assets or Leverage ratio	Q	1Q					√				√				√				√
Nonperforming loans net of provisions to capital	Q	1Q					√				√				√				√
Nonperforming loans to total gross loans	Q	1Q					√				√				√				√
Return on assets	Q	1Q					√				√				√				√
Liquid assets to short-term liabilities or Liquidity coverage ratio	Q	1Q					√				√				√				√
Residential real estate prices	Q	1Q					√				√				√				√
Debt Securities	Q	4M					√				√				√				√
External Sector																			
Balance of payments	Q	1Q					√				√				√				√
Official reserve assets	M	1W		√	√	√		√	√	√		√	√	√		√	√	-2	
Reserves template†	M	1M		√	√	√		√	√	√		√	√	√		√	√	√	
Merchandise trade	M	8W		√	√	√		√	√	√		√	√	√		√	√	√	
International investment position	Q	1Q					√				√				√				√
External debt	Q	1Q					√				√				√				√
Socio-demographic Data																			
Population	A	...																	

Source: AOR 2023 for Switzerland (IMF 2023).

Table 2. Switzerland, 2023: Punctuality Against the Advance Release Calendar

Unshaded cells reflect SDDS Plus prescribed periodicity; entries in shaded cells reflect cases where SDDS Plus prescribed periodicity is exceeded or where flexibility options are used.
√ – data were released on the date shown on the advance release calendar (ARC); × – data were not disseminated; O – no ARC release dates provided; NYD – data not yet disseminated;
P – pending release; positive numeric entry – number of days dissemination was earlier than the release date on the ARC; negative numeric entry – number of days dissemination was later than the release date on the ARC; S – next to an observation indicates release related to semi-annual data.

Data Category	National Periodicity	National Release Lag	Reference Period																
			Prev yr	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Jul	Aug	Sep	Q3	Oct	Nov	Dec	Q4
Real Sector																			
National accounts	Q	62D *					√				√				√				O
Production index	Q -PF	1Q -TF					-323				-235				-144				-53
Sectoral stocks of financial assets and liabilities	Q	4M					√				√				√				√
Labor market: Employment	Q	2M *					4				3				3				√
Labor market: Unemployment	M *	NLT 2W *		-22	-66	-36		-7	-36	-6		-31	√	-13		√	√	√	
Labor market: Wages/Earnings	Q	1Q					-16				√				√				NYD
Price index: Consumer prices	M	NLT 2W *		√	√	√		√	√	√		√	√	√		√	√	√	
Price index: Producer prices	M	16D *		√	√	√		√	√	√		√	√	√		√	√	√	
Fiscal Sector																			
General Government Operations	Q	2Q					√				√				O				√
General government gross debt	Q	3M *					√				√				O				√
Central government operations	M	1M		√	√	√		√	√	-2		√	√	-30		√	O	O	
Central government debt	Q	3M					√				√				O				√
Financial Sector																			
Depository corporations survey	M	1M		√	√	√		√	√	√		√	√	√		√	√	√	
Central bank survey	M	2W		√	√	√		√	√	√		√	√	√		√	√	√	
Other financial corporations survey	Q	3M *					√				√				√				√
Regulatory Tier 1 capital to risk-weighted assets	Q	1Q					√				√				√				√
Regulatory Tier 1 capital to assets or Leverage ratio	Q	1Q					√				√				√				√
Nonperforming loans net of provisions to capital	Q	1Q					√				√				√				√
Nonperforming loans to total gross loans	Q	1Q					√				√				√				√
Return on assets	Q	1Q					√				√				√				√
Liquid assets to short-term liabilities or Liquidity coverage ratio	Q	1Q					√				√				√				√
Residential real estate prices	Q	1Q					√				√				√				√
Debt Securities	Q	3M *					√				√				√				√
External Sector																			
Balance of payments	Q	1Q					√				√				√				√
Official reserve assets	M	1W		√	√	√		√	√	√		√	√	√		√	√	√	
Reserves template†	M	1M		√	√	√		√	√	√		√	√	√		√	√	√	
Merchandise trade	M	30D *		√	√	√		√	√	√		√	√	√		√	√	√	
International investment position	Q	1Q					√				√				√				√
External debt	Q	1Q					√				√				√				√
Socio-demographic Data																			
Population	A	NLT3Q	√																

Source: AOR 2023 for Switzerland (IMF 2023).

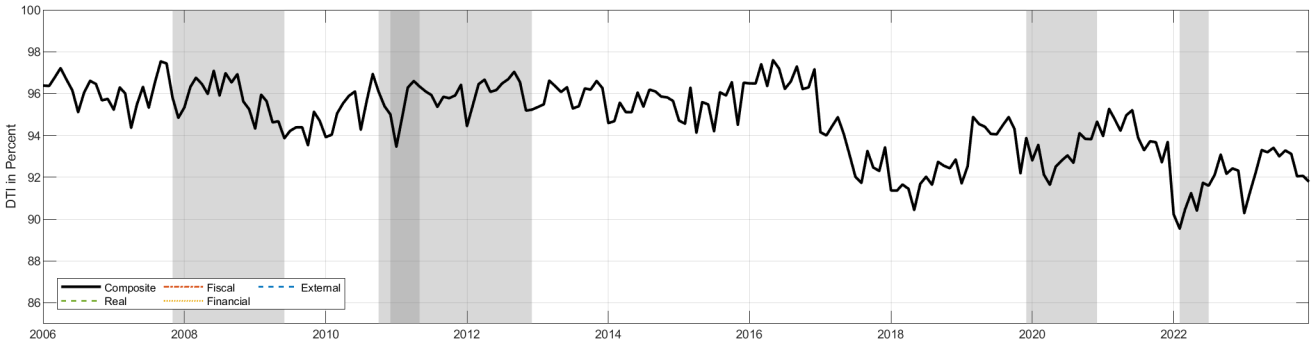
B SDDS Subscribers and SDDS Plus Adherents

(as of end-2023)

SDDS	Region	Income Level	**Date Meeting SDDS Specifications**	**SDDS Plus**	Region	Income Level	**Date of Adherence**
Argentina (ARG)	WHD	EME	1-Nov-1999	Austria (AUT)	EUR	AE	10-Jan-2017
Armenia (ARM)	MCD	EME	7-Nov-2003	Belgium (BEL)	EUR	AE	26-Jan-2023
Australia (AUS)	APD	AE	23-Jul-2001	Brazil (BRA)	WHD	EME	14-Nov-2019
Belarus, Republic of (BLR)	EUR	EME	22-Dec-2004	Bulgaria (BGR)	EUR	EME	31-May-2016
China, P.R.: Hong Kong (HKG)	APD	AE	12-Jul-2000	Canada (CAN)	WHD	AE	11-Apr-2017
China, People's Republic (CHN)	APD	EME	7-Oct-2015	Chile (CHL)	WHD	EME	20-Mar-2020
Colombia (COL)	WHD	EME	9-May-2000	Czech Republic (CZE)	EUR	AE	4-Apr-2016
Costa Rica (CRI)	WHD	EME	28-Nov-2001	Denmark (DNK)	EUR	AE	3-Jan-2017
Croatia (HRV)	EUR	AE	30-Mar-2001	Estonia (EST)	EUR	AE	11-Jan-2022
Cyprus (CYP)	EUR	AE	1-Dec-20091	Finland (FIN)	EUR	AE	6-Jun-2018
Ecuador (ECU)	WHD	EME	14-Jul-2000	France (FRA)	EUR	AE	18-Feb-2015
Egypt (EGY)	MCD	EME	31-Jan-2005	Germany (DEU)	EUR	AE	17-Feb-2015
El Salvador (SLV)	WHD	EME	12-Oct-1999	Hungary (HUN)	EUR	EME	7-Jul-2022
Georgia (GEO)	MCD	EME	17-May-2010	Israel (ISR)	EUR	AE	22-Dec-2020
Greece (GRE)	EUR	AE	8-Nov-2002	Italy (ITA)	EUR	AE	18-Feb-2015
Iceland (ISL)	EUR	AE	30-Jun-2004	Japan (JPN)	APD	AE	18-Apr-2016
India (IND)	ADP	EME	14-Dec-2001	Latvia (LVA)	EUR	AE	1-Aug-2018
Indonesia (IDN)	ADP	EME	2-Jun-2000	Lithuania (LTU)	EUR	AE	19-Jul-2018
Ireland (IRE)	EUR	AE	17-Jul-2001	Luxembourg (LUX)	EUR	AE	18-Nov-2019
Jordan (JOR)	MCD	EME	28-Jan-2010	Malta (MLT)	EUR	AE	28-Jul-2023
Kazakhstan (KAZ)	MCD	EME	24-Mar-2003	Netherlands (NDL)	EUR	AE	27-Jan-2015
Korea (KOR)	APD	AE	1-Nov-1999	North Macedonia, Republic of (MKD)	EUR	EME	28-Jan-2019
Kyrgyz Republic (KGZ)	MCD	DE	26-Feb-2004	Portugal (PRT)	EUR	AE	11-Feb-2015
Malaysia (MYS)	APD	EME	1-Sep-2000	Romania (ROU)	EUR	EME	5-Nov-2019
Mauritius (MUS)	AFR	EME	28-Feb-2012	Slovak Republic (SVK)	EUR	AE	16-Sep-2019
Mexico (MEX)	WHD	EME	29-Jun-2000	Slovenia (SVN)	EUR	AE	7-Feb-2020
Moldova, Republic of (MDA)	EUR	DE	2-May-2006	Spain (ESP)	EUR	AE	12-Feb-2015
Mongolia (MNG)	APD	EME	1-Apr-2019	Sweden (SWE)	EUR	AE	11-Feb-2015
Morocco (MAR)	MCD	EME	15-Dec-2005	Switzerland (CHE)	EUR	AE	19-Jan-2021
Namibia (NAM)	AFR	EME	15-Dec-2022	United Kingdom (GBR)	EUR	AE	23-Aug-2022
Norway (NOR)	EUR	AE	28-Apr-2000	United States (USA)	WHD	AE	18-Feb-2015
Norway (NOR)	EUR	AE	28-Apr-2000				
Peru (PER)	WHD	EME	15-Jul-1999				
Philippines (PHL)	APD	EME	17-Jan-2001				
Poland (POL)	EUR	EME	2-Mar-2000				
Russian Federation (RUS)	EUR	EME	31-Jan-2005				
Saudi Arabia (SAU)	MCD	EME	18-Sep-2019				
Senegal (SEN)	AFR	DE	20-Nov-2017				
Seychelles (SYC)	AFR	EME	1-May-2015				
Singapore (SGP)	APD	AE	30-Jan-2001				
South Africa (ZAF)	AFR	EME	18-Sep-2000				
Sri Lanka (LKA)	APD	EME	3-Nov-2015				
Thailand (THA)	APD	EME	16-May-2000				
Tunisia (TUN)	MCD	EME	20-Jun-2001				
Türkiye, Republic of (TUR)	EUR	EME	20-Jul-2001				
Ukraine (UKR)	EUR	EME	10-Jan-2003				
Uruguay (URY)	WHD	EME	12-Feb-2004				
West Bank and Gaza (WBG)	MCD	EME	19-Apr-2012				

Notes: Income level—AE: advanced economy; DE: developing economy; EME: emerging market economy, following IMF economy classification. Regions—AFR: Sub-Saharan Africa; APD: Asia/Pacific; EUR: Europe; MCD: Middle East/Central Asia; WHD: Western Hemisphere.

C Punctuality-based Global Composite DPI



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. The composite DPI is shown. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

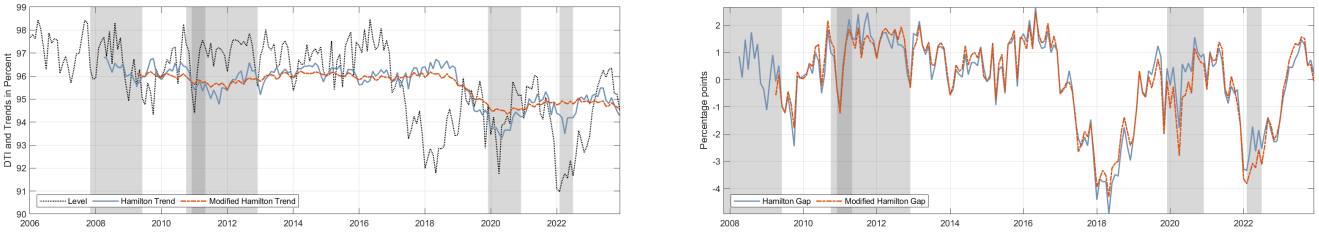
D Trends and Gaps: Through an Econometric Lens

Trends and gaps in the global DTI are further investigated through the lens of econometric trend-cycle decompositions. The left panel shows the composite global DTI (black dotted line), alongside Hamilton-type trend estimates and the right panel shows Hamilton-type cyclical estimates (Hamilton 2018, Quast & Wolters 2022). Hamilton (2018) suggests to derive the trend of a time series from an autoregressive process, including the series' four most recent lags and a constant. The cyclical component then reflects unexpected deviations from a two-year-ahead forecast. Quast & Wolters (2022) build on Hamilton's proposal but suggest to consider a simple forecast-averaging approach around Hamilton's forecast horizon, considering an average of one-to-three-year-ahead forecasts which smooths erratic noise in the trend and cyclical estimates introduced by movements in the global DTI two years prior.[35]

Both trend measures show an overall declining trend, especially after 2017, from around 96-97 percent to around 94-95 percent. Gaps between index levels and the underlying trend widened in recent years. They also became more persistent as they did not revert or close as quickly as earlier in the sample.

[35]For Hamilton's filter, a forecast horizon of 24 months and for the modified Hamilton filter, forecast horizons between 12 and 36 months are considered. Note that the estimated coefficients are informed by the whole sample period, despite the filters' one-sided natures.

Figure 12: Hamilton-type Global DTI Trend and Gap Estimates



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations of Hamilton-type trend and gap estimates of the global composite DTI (Hamilton 2018, Quast & Wolters 2022). Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

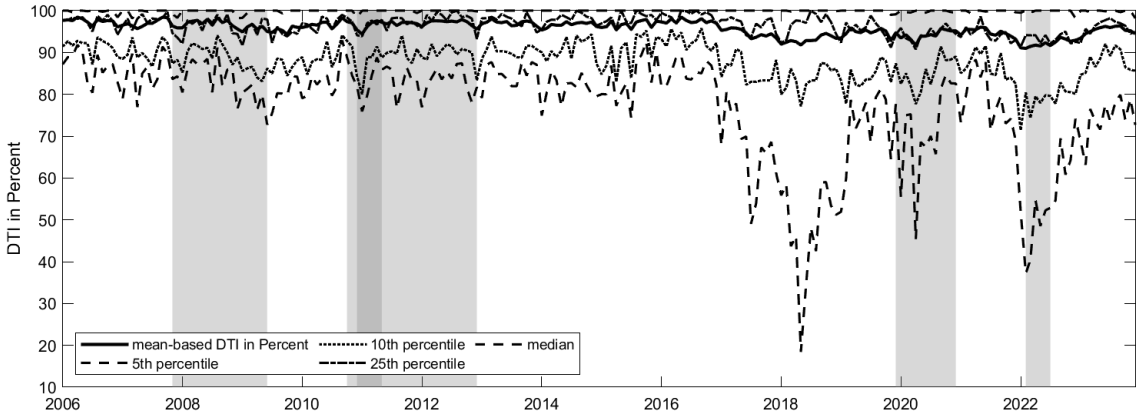
E Distributional, Robustness, and Sensitivity Perspectives

This annex investigates compositional driving forces of the DTI and the potential role of the flexible and changing composition for index aggregation.

E.1 The Global Composite DTI through a Distributional Lens

Figure 13 shows distributional details through tracking the 5^{th}, 10^{th}, 25^{th} percentiles, the median, and the mean-based global composite DTI and reveals several key insights.

Figure 13: DTI-Dispersion



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. The figure shows the 5^{th}, 10^{th}, 25^{th} percentiles, the median, and the mean-based global composite DTI. Gray shades show the following historic events/episodes: GFC (end-2007—mid-2009), euro area crisis (end-2010—end-2012), Arab Spring (end-2010—mid-2011), first year of Covid-19 pandemic (Dec 2019—end-2020), and the early phase of Russia's invasion of Ukraine (Feb 2022—July 2022).

First, more than 50 percent of subscribers maintain consistently timely data releases each month, demonstrating that the IMF Data Standards Initiatives provide a policy framework in which high DTI-levels can be maintained if subscribers comply. Second, the mean-based composite index is importantly driven by weaker performances. Weak performances of the bottom

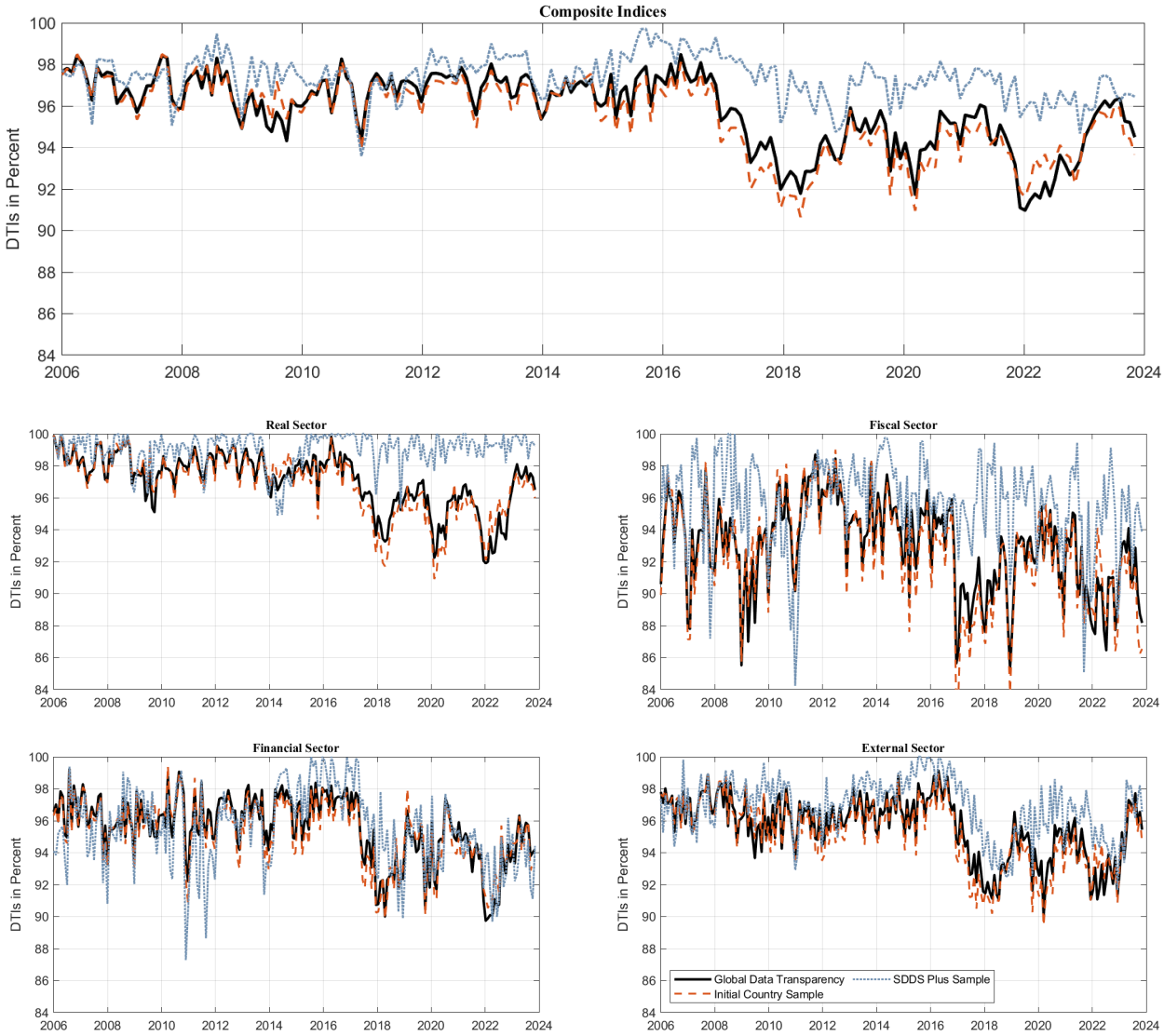
three to eight subscribers drive the major downward spikes. Third, the more persistent downward shift in performance since 2017 is visible up to the 25^{th} percentile, which corresponds to up to about 19 economies, and pulls down the mean more toward the 25^{th} percentile. Fourth, the 10^{th} and 25^{th} percentiles exhibit persistent declines since 2017, while the 5^{th} percentile shows recovery tendencies but exhibits stark declines around periods of distress.

E.2 What is the Role of Economy Composition for the Aggregate Indices?

How does the flexible and changing economy-composition affect the key results? The global DTIs are constructed to include subscribers as soon as they subscribe to SDDS. As subscribers progress through the tiers of the IMF Data Standards Initiatives, the number of subscribers that contribute to the global indices evolves accordingly (see figure 1). We examine to what extent this may drive DTI dynamics. Two alternative compositions are considered and plotted alongside the global composite and DTIs per statistical domain (solid lines) in figure 14. The dash-dotted lines reflect the average performance among the initial set of subscribers, not considering those that subscribed to SDDS after 2006. The dotted lines reflect the average performance among the SDDS Plus adherents as of 2023, but tracked over the whole sample as if the group had existed since 2006.

Comparing the global composite and DTIs per statistical domain against both, the initial subscriber group and the backcasted group of SDDS Plus subscribers, shows remarkable consistency in overall trends, though SDDS Plus subscribers maintain higher performance, particularly with respect to real sector data timeliness. This consistency across sample compositions demonstrates that the addition of 16 new SDDS subscribers did not materially drive global DTI dynamics. While SDDS Plus subscribers show some advantages in fiscal and external reporting during specific periods, their financial sector performance largely mirrors composite dynamics.

Figure 14: Alternative Economy Compositions



Sources and notes: IMF SDDS and SDDS Plus AORs and author's computations. The figure shows the global composite DTI (solid curves), alongside two alternative compositions for index aggregation: one following the initial subscribers (dashed curves) and one following the end-of-2023 SDDS Plus subscribers over the whole sample.

F Early Warning Properties: Additional Results, Alternative Specifications, and Robustness

This appendix provides detailed results as well as alternative and robustness specifications to the early warning property exercise. Table 2 shows estimation results for the baseline specification, alongside those from alternative model specifications that assess robustness along two dimensions: (i) varying the number of lags of DTI growth and (ii) consecutively adding macroeconomic variables to see if they increase the predictive power of the model. Moreover, results for the four subindices per statistical domains are shown as well.

Table 2: Baseline Results and Results for Alternative Logit Specifications

	Business Cycle Recessions				Systemic Crises			
Model Specification	**Coefficient**	**AUROC**	**[95% Conf. Int.]**		**Coefficient**	**AUROC**	**[95% Conf. Int.]**	
Baseline: DTI growth – 16 quarters	-0.244***	0.722	[0.701	0.743]	-0.009	0.686	[0.611	0.760]
DTI growth: 12 quarters	-0.082*	0.714	[0.694	0.734]	-0.071	0.678	[0.608	0.748]
DTI growth: 20 quarters	-0.016	0.728	[0.707	0.749]	0.543	0.725	[0.653	0.796]
DTI and real GDP growth (16 quarters)	-0.207**	0.777	[0.758	0.796]	-0.142	0.750	[0.681	0.818]
DTI and inflation (16 quarters)	-0.263***	0.735	[0.714	0.756]	0.434	0.784	[0.724	0.844]
DTI and private credit growth (4 years) (annual)	0.027	0.735	[0.698	0.772]	0.131	0.864	[0.740	0.988]
DTI and public debt growth (4 years) (annual)	0.023	0.737	[0.702	0.772]	-0.040	0.791	[0.650	0.932]
Real subindex (16 quarters)	-0.257***	0.721	[0.670	0.742]	0.198	0.680	[0.602	0.757]
Fiscal subindex (16 quarters)	-0.033	0.717	[0.696	0.739]	-0.243***	0.711	[0.634	0.787]
Financial subindex (16 quarters)	-0.090	0.719	[0.698	0.740]	-0.040	0.687	[0.611	0.763]
External subindex (16 quarters)	-0.102	0.720	[0.699	0.741]	0.774***	0.693	[0.617	0.769]

Notes: *, **, and *** indicate coefficients that are statistically significantly different from zero at the 10, 5, and 1% level.

With regards to the baseline, the DTI-growth coefficient is estimated as -0.24 in the business-cycle-recession-exercise, and is statistically significant at the 99% confident level. This suggests that increasingly timelier data releases are associated with decreasing odds for a business cycle recession to occur.[36] Coefficients are also estimated to be negative across different DTI-growth lag structures. The size of the estimated coefficients suggests that including three years of past values may not add enough information. Including up to five years of lags, however, does not add much precision to the estimates, especially in the systemic-crises-exercise. Including four lags of DTI growth, thus, appears to be a reasonable choice.

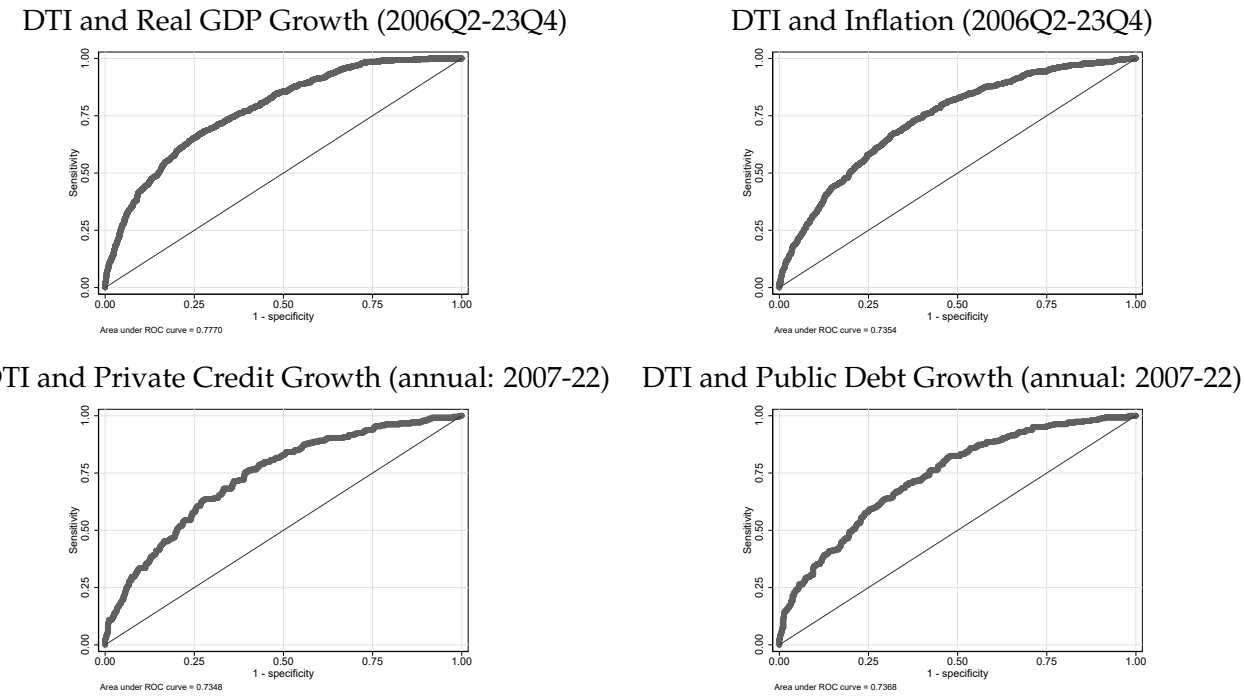
In a second set of alternative specifications, macroeconomic variables are added to check if the main findings remain robust. For real GDP growth and inflation, quarterly specifications are run. For private credit growth and public debt, annual specifications are run since private credit and public debt data is available on an annual basis in the IMF's GFS and global debt (Mbaye et al. 2018) databases for a large set of economies.[37]

[36]Note that the fewer and only annually available systemic crises observations likely explain why coefficients are estimated less precisely in the systemic-crisis-exercise.

[37]Considering interpolated credit series would introduce a pronounced degree of hindsight knowledge to the

Figures 15 and 16 show the ROC curves for these specifications. Adding macroeconomic series improves the predictive power of the model. For signaling business cycle recessions, adding lagged real GDP growth increases the AUROC statistic, while adding lagged inflation, private credit growth, or public debt growth does not increase it considerably compared to the baseline specification. When it comes to signaling systemic crises, adding macroeconomic variables helps. In line with Schularick & Taylor (2012) including private credit growth improves the predictive ability of the model the most.[38] The main purpose of this exercise is to gauge whether DTIs provide useful information for economic developments and not necessarily to optimize the model specification with respect to crisis prediction. The main insight that DTIs contain useful predictive content indeed remains robust across these different specifications.

Figure 15: ROC Analysis and Alternative Model Specifications - Business Cycle Recessions



Notes: Business cycle recessions are derived as economy-specific Bry-Bochan-type recessions (Bry & Boschan 1971). Four years of lags are included for explanatory variables in the quarterly and the yearly specifications, respectively.

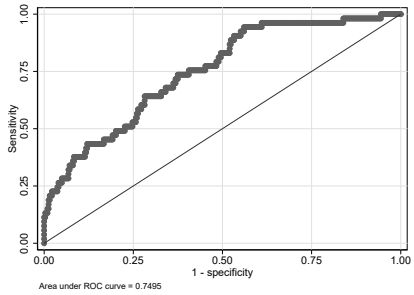
Looking at the subindices per statistical domain indicates that the changes in real and external DTIs are associated with the highest AUROC statistics in the business-cycle-recession-exercise, whereas decreasing fiscal DTIs are associated with the highest predictive ability for systemic crises. Figures 17 and 18 show the respective ROC curves. This suggests that the

exercise since commonly used techniques use two-sided interpolation and smoothing to infer missing values. Especially when investigating early warning properties, this is not innocent.

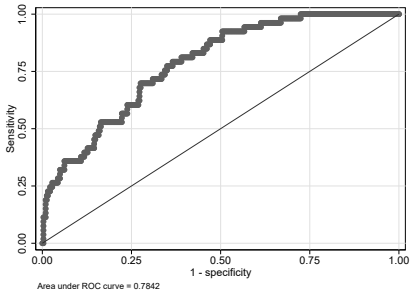
[38] Coefficient estimates for the private credit and the public debt specifications in both crises exercise cannot be distinguished from zero. One reason may be related to the evidence presented in Hartwig et al. (2021) who show that measures of private credit growth find it hard to provide coherent signals for systemic risk. For some economies, systemic risk is signaled by high values of measures for private credit growth, whereas low values signal it for other economies.

Figure 16: ROC Analysis and Alternative Model Specifications - Systemic Crises

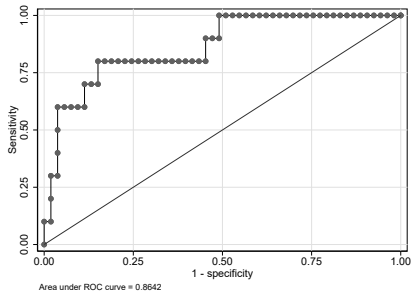
DTI and Real GDP Growth (2006Q2-19Q4)



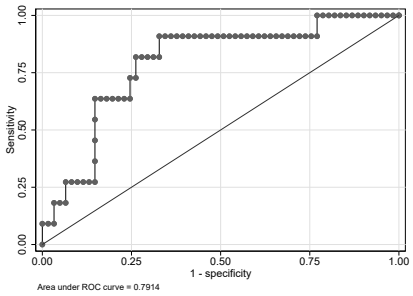
DTI and Inflation (2006Q2-19Q4)



DTI and Private Credit Growth (annual: 2007-19)



DTI and Public Debt Growth (annual: 2007-19)



Notes: Systemic crises come from Laeven & Valencia's (2020) updated database, which is amended by Nguyen et al. (2022) for the years 2018-19, and all types of systemic crises recorded therein are considered jointly. Four years of lags are included for explanatory variables in the quarterly and the yearly specifications, respectively.

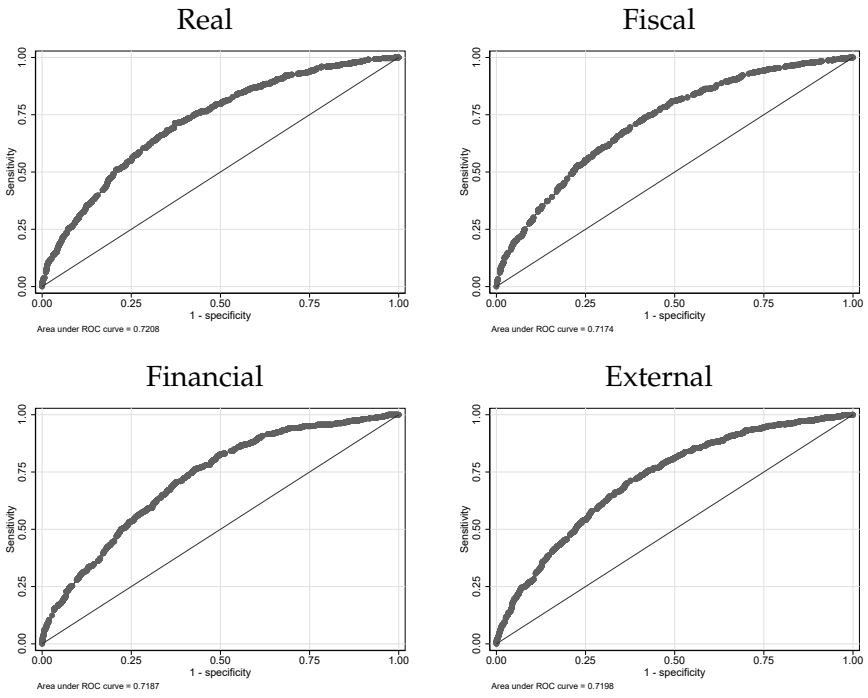
subindices contain distinct information. This aligns well with the insight gained above: if real data releases, that are usually disseminated the most timely, start to be disseminated less timely, this tends to be associated with broader-based economic turmoil.

In a final exercise, we investigate single systemic crises types. Figure 19 shows ROC curves for DTIs per statistical domain being used as classifiers for sovereign debt crises. The financial, fiscal, and external subindices are associated with high AUROC statistics of well above 0.8. Real DTIs tend to convey less signaling information for sovereign debt crises.

For the other two types of systemic crises, evidence is more mixed. For currency crises, predictive content from the sub-DTIs is less distinct. Yet, for all four of them, AUROC statistics are above 0.5, ranging between 0.61 (external) and 0.67 (fiscal). Fiscal DTIs convey the most indicative information, whereas external DTIs convey the least. This aligns with the insight that difficulties to uphold timely publication of fiscal data can be indicative of underlying structural issues. For banking crises, the real and especially the external DTIs convey signaling information.[39]

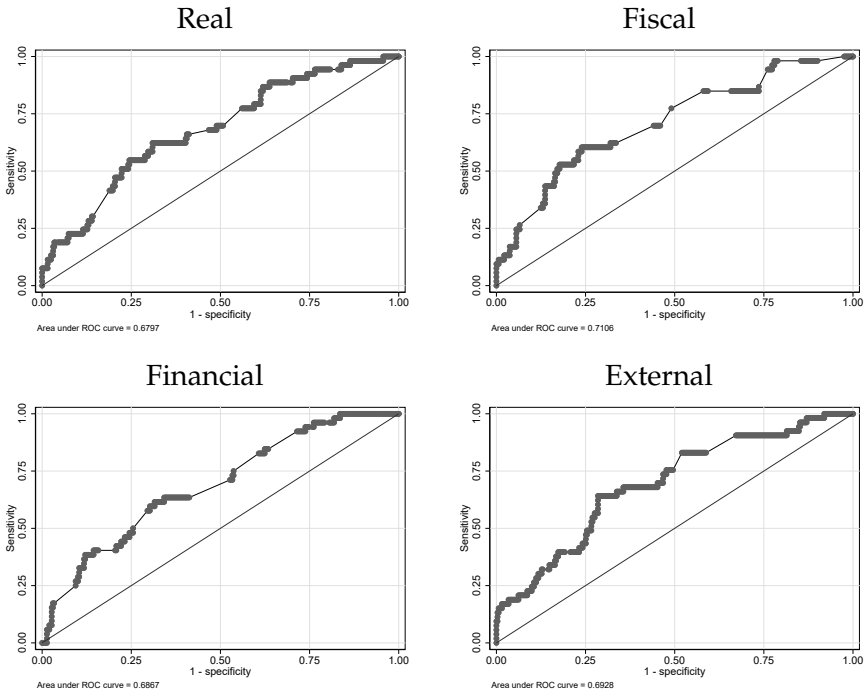
[39]Financial crises observations cluster around the GFC over the studied sample.

Figure 17: Baseline ROC Curves for Subindices per Statistical Domain: Business Cycle Recessions



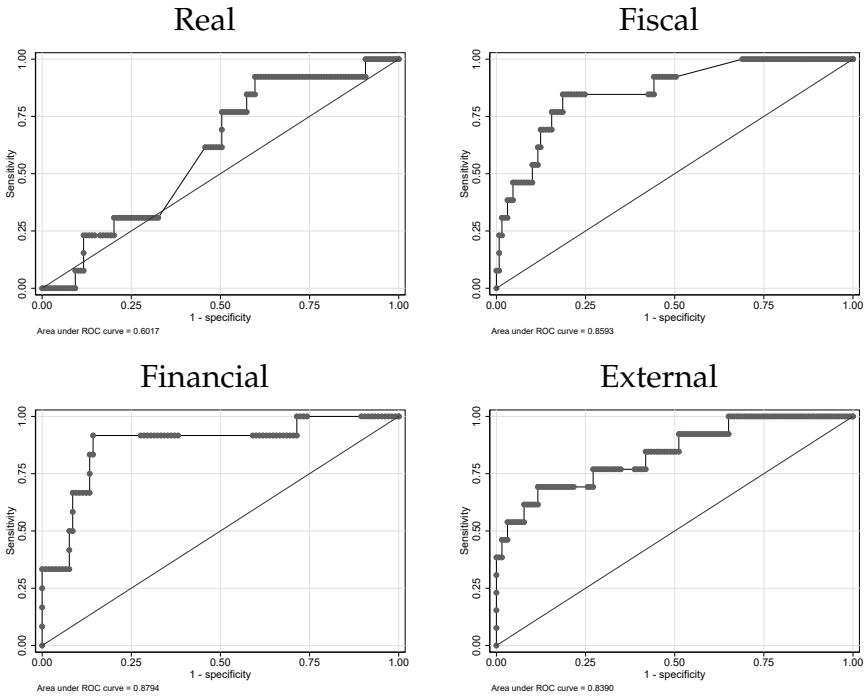
Notes: Business cycle recessions are derived as economy-specific Bry-Bochan-type recessions (Bry & Boschan 1971). Four years of lagged variables, i.e., 16 quarters, are included for the explanatory subindex DTI-variable.

Figure 18: Baseline ROC Curves for Subindices per Statistical Domain: Systemic Crises



Notes: Systemic crises come from Laeven & Valencia's (2020) updated database, which is amended by Nguyen et al. (2022) for the years 2018-19, and all types of systemic crises recorded therein are considered jointly. Four years of lagged variables, i.e., 16 quarters, are included for the explanatory subindex DTI-variable.

Figure 19: ROCs: DTIs per Statistical Domain and Sovereign Debt Crises



Notes: Sovereign Debt Crises come from Laeven & Valencia's (2020) updated database, which is amended by Nguyen et al. (2022) for the years 2018-19. Four years of lagged variables, i.e., 16 quarters, are included for the explanatory DTI-variable.

PUBLICATIONS

Behind Schedule? Assessing Global Developments in the Provision of Economic Statistics

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