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Subnational and regional accounts**The Compilation of Quarterly GRDP of 514 Regencies and Cities in Indonesia (A recent study in Statistics Indonesia)****Prepared by BPS-Statistics Indonesia¹***Summary*

Recent global economic trends, accelerated by the impact of the pandemic, have highlighted the need for more frequent and detailed economic data at the regencies and cities in Indonesia. One of them is the demand for quarterly GRDP compilation at the 514 regencies / cities in Indonesia from various stakeholders, including policymakers. Two main reasons underpinning the necessity of quarterly regency/city-level GRDP in Indonesia include: High demand for quarterly regency/city -level GRDP from data users; High-frequency indicators such as quarterly GRDP are essential for prompt policy responses, especially during rapidly changing economic conditions as witnessed during the covid 19; and, The need for quarterly GRDP for economic modeling at the regency/ city level.

In late 2023, BPS started the first study on compiling quarterly GRDP 2018-2023 of 514 regencies / cities. The activities consist of benchmarking the annual GRDP data to quarterly for the period of 2018 – 2022, as well as estimating the GRDP of regencies and cities for Quarter I and II year 2023. Despite all challenges and resource constraints, BPS successfully completed the quarterly GRDP for regency/city-level data, spanning 17 industries from Q1 2018 to Q2 2023, where it is found that the average discrepancy between quarterly provincial GRDP and quarterly GRDP of regencies and cities is mostly less than 1 percent. Lessons learned from this study emphasize the need to enhance cooperation with other ministries and institutions to obtain supplementary data for improving the quality of quarterly regency GRDP. Internally, BPS must provide disaggregated data at the regency/city level, and capacity-building efforts within regional BPS offices are deemed beneficial. Lastly, more detailed data presentation in the tables is recommended to improve the value of the data for users.

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I. Introduction

1. Gross Regional Domestic Product (GRDP) stands as a pivotal indicator for gauging the economic performance of a region over a specified period. It represents the total value added by all industries within a specific area or the aggregate final value of goods and services produced by all economic entities. GRDP serves to illustrate overall economic growth or the performance of individual sectors over consecutive periods. Recognizing the demand from numerous data users for quarterly GRDP data, particularly amid the necessity to swiftly respond to policy changes, notably during crises such as the COVID-19 pandemic, and for economic modeling at the smaller regional level, in 2023, BPS initiated a study on compiling Quarterly Regency/City GRDP.
2. The objectives of this study are; to produce data on the GRDP of regencies / cities by industry in the quarterly period for the period that has passed (back series) and for the current period (forward series); to identify the availability of necessary data needed for compiling quarterly regency/city GRDP; to review the business process of preparing the regency/city GRDP in the quarterly period, which includes methods and procedures for compilation, scope, levels, systems, schedules, and revision policies; and, to increase the capacity of BPS human resources in preparing the compilation of quarterly regency/city GRDP in accordance with international guidelines.
3. Quarterly GRDP of regencies and cities will be useful for analyzing short-term volatility and business cycles; generating more data periods for forecasting compared to annual GDP; and providing a more comprehensive and consistent economic overview compared to other short-term indicators.

II. Methodology

A. Data

4. The data used in the study on compiling GRDP of regencies and cities come from various sources, such as internal BPS, ministries/agencies/institutions, company reports, and other sources. From data source identification phase, we found that, in general the main data sources used are from BPS. However, if we zoom in, still only a few industries source their data from BPS, making provincial and regency/city BPS offices require other external data sources to produce quarterly GRDP by industry. Thus, the support of sectoral data from ministries/agencies/institutions plays an important role.
5. Furthermore, we discovered that several industries still lack robust data support from both BPS and ministries/agencies/institutions, prompting provincial and district/city BPS offices to explore alternative data sources. These industries include; Agriculture services and hunting (A.1.g); Wholesale trade and retail trade except of motor vehicles and motorcycles (G.2); River, lake, and ferry transport (H.4); Warehousing and support services for transportation, postal and courier (H.6); Other financial services (K.3); Financial supporting services (K.4)
6. In detail, the overview of data source for each industry is shown in Table 1 and Table 2. From these tables, it is evident that, unlike production data and indicators, data sources for price data and indicators in the compiling quarterly GRDP of regencies and cities generally come from BPS as most provinces have used price data and indicators from BPS due to limited availability elsewhere.

Table 1
The status of production data and indicators availability

Industry		Percentage of Provinces by Source of Data Used (%)			
		BPS	ministries/ agencies/ institutions	Company reports	Others
(1)		(2)	(3)	(4)	(5)
A. Agriculture, forestry and fishing		100.00	88.24	23.53	41.18
1	Agriculture, livestock, hunting and agriculture services	100.00	85.29	11.76	38.24
	a. Food crops	97.06	47.06	0.00	14.71
	b. Horticultural crops	82.35	52.94	0.00	11.76
	c. Plantation crops	34.48	51.72	3.45	24.14
	d. Annual horticultural crops and others	85.29	50.00	0.00	11.76
	e. Other plantation	66.67	69.70	6.06	18.18
	f. Livestock	70.59	79.41	2.94	14.71
	g. Agriculture services and hunting	44.12	26.47	0.00	35.29
2	Forestry and Logging	33.33	69.70	9.09	18.18
3	Fishery	61.76	82.35	8.82	11.76
B. Mining and quarrying		82.35	76.47	41.18	38.24
1	Crude petroleum, natural gas, and geothermal	50.00	68.18	18.18	22.73
2	Coal and lignite mining	35.71	71.43	21.43	21.43
3	Iron ore mining	50.00	35.71	32.14	25.00
4	Other mining and quarrying	79.41	44.12	2.94	32.35
C. Manufacturing		94.12	44.12	29.41	29.41
1	Manufacture of coal and refined petroleum products	64.29	42.86	35.71	28.57
	a. Manufacture of coal	0.00	50.00	50.00	50.00
	b. Manufacture of refined petroleum products	75.00	41.67	33.33	25.00
2	Manufacture of food products and beverages	88.24	23.53	5.88	20.59
3	Manufacture of tobacco products	66.67	16.67	5.56	33.33
4	Manufacture of textiles; and wearing apparel	88.24	11.76	2.94	20.59
5	Manufacture of leather and related products and footwear	81.82	9.09	4.55	13.64
6	Manufacture of wood and of products of wood and	85.29	14.71	5.88	20.59

Industry		Percentage of Provinces by Source of Data Used (%)			
		BPS	ministries/ agencies/ institutions	Company reports	Others
(1)		(2)	(3)	(4)	(5)
	cork, and articles of straw and plaiting materials				
7	Manufacture of paper and paper products, printing and reproduction of recorded media	82.35	14.71	11.76	20.59
8	Manufacture of chemicals and pharmaceuticals and botanical products	79.41	11.76	5.88	20.59
9	Manufacture of rubber, rubber products and plastics products	81.25	25.00	12.50	21.88
10	Manufacture of other non-metallic mineral products	91.18	8.82	8.82	20.59
11	Manufacture of basic metals	78.95	21.05	0.00	15.79
12	Manufacture of fabricated metal products, computer, and optical products, and electrical equipment	88.24	11.76	2.94	20.59
13	Manufacture of machinery and equipment	90.00	5.00	5.00	20.00
14	Manufacture of transport equipment	84.85	12.12	6.06	24.24
15	Manufacture of furniture	88.24	11.76	2.94	20.59
16	Other manufacturing, repair and installation of machinery and equipment	82.35	11.76	2.94	20.59
D. Electricity and Gas		67.65	35.29	64.71	20.59
1	Electricity	17.65	35.29	64.71	8.82
2	Manufacture of gas and production of ice	67.65	11.76	29.41	20.59
E. Water supply, sewerage, waste management and remediation activities		61.76	29.41	55.88	20.59
F. Construction		55.88	58.82	26.47	32.35
G. Wholesale and retail trade; repair of motor vehicles and motorcycles		44.12	58.82	32.35	50.00
1	Wholesale and retail trade and repair of motor vehicles and motorcycles	26.47	52.94	32.35	38.24
2	Wholesale trade and retail trade except of motor vehicles and motorcycles	41.18	35.29	8.82	47.06
H. Transportation and storage		85.29	64.71	55.88	47.06
1	Railways transport	50.00	10.00	50.00	20.00
2	Land transport	23.53	52.94	20.59	29.41

Industry		Percentage of Provinces by Source of Data Used (%)			
		BPS	ministries/ agencies/ institutions	Company reports	Others
(1)		(2)	(3)	(4)	(5)
3	Sea transport	81.82	39.39	6.06	15.15
4	River, lake, and ferry transport	42.42	48.48	21.21	27.27
5	Air transport	76.47	32.35	23.53	14.71
6	Warehousing and support services for transportation, postal and courier	38.24	38.24	38.24	35.29
I. Accommodation and food and beverage service activities		91.18	44.12	2.94	20.59
1	Accommodation	85.29	26.47	2.94	20.59
2	Food and beverage service activities	76.47	41.18	0.00	20.59
J. Information and communication		50.00	20.59	26.47	32.35
K. Financial and insurance activities		44.12	73.53	17.65	41.18
1	Financial intermediary services	44.12	67.65	5.88	29.41
2	Insurance and pension fund	20.59	50.00	11.76	32.35
3	Other financial services	20.59	47.06	14.71	32.35
4	Financial supporting services	23.53	35.29	8.82	32.35
L. Real estate		58.82	26.47	8.82	38.24
M,N. Business activities		70.59	23.53	14.71	29.41
O. Public administration and defence; compulsory social security		38.24	94.12	2.94	17.65
P. Education		76.47	76.47	5.88	23.53
Q. Human health and social work activities		79.41	73.53	14.71	23.53
R,S,T,U. Other services activities		76.47	44.12	8.82	29.41

Table 2
The status of price data and indicators availability

Industry		Percentage of Provinces by Source of Data Used (%)			
		BPS	ministries/ agencies/ institutions	Company reports	Others
(1)		(2)	(3)	(4)	(5)
A. Agriculture, forestry and fishing		94.12	26.47	2.94	17.65
1	Agriculture, livestock, hunting and agriculture services	94.12	23.53	2.94	17.65
	a. Food crops	94.12	14.71	2.94	14.71
	b. Horticultural crops	88.24	20.59	2.94	17.65
	c. Plantation crops	79.31	20.69	3.45	17.24
	d. Annual horticultural crops and others	85.29	11.76	2.94	17.65
	e. Other plantation	84.85	12.12	3.03	18.18
	f. Livestock	88.24	14.71	2.94	14.71
	g. Agriculture services and hunting	82.35	5.88	2.94	14.71
2	Forestry and Logging	81.82	9.09	3.03	15.15
3	Fishery	91.18	23.53	2.94	14.71
B. Mining and quarrying		85.29	29.41	26.47	29.41
1	Crude petroleum, natural gas, and geothermal	68.18	31.82	27.27	18.18
2	Coal and lignite mining	78.57	35.71	14.29	21.43
3	Iron ore mining	78.57	10.71	14.29	28.57
4	Other mining and quarrying	85.29	5.88	5.88	20.59
C. Manufacturing		91.18	17.65	8.82	17.65
1	Manufacture of coal and refined petroleum products	85.71	7.14	14.29	14.29
	a. Manufacture of coal	50.00	0.00	50.00	50.00
	b. Manufacture of refined petroleum products	91.67	8.33	8.33	8.33
2	Manufacture of food products and beverages	88.24	8.82	2.94	8.82
3	Manufacture of tobacco products	83.33	5.56	5.56	22.22
4	Manufacture of textiles; and wearing apparel	88.24	5.88	2.94	11.76
5	Manufacture of leather and related products and footwear	81.82	4.55	4.55	9.09
6	Manufacture of wood and of products of wood and	88.24	8.82	2.94	11.76

Industry		Percentage of Provinces by Source of Data Used (%)			
		BPS	ministries/ agencies/ institutions	Company reports	Others
(1)		(2)	(3)	(4)	(5)
	cork, and articles of straw and plaiting materials				
7	Manufacture of paper and paper products, printing and reproduction of recorded media	85.29	5.88	2.94	11.76
8	Manufacture of chemicals and pharmaceuticals and botanical products	82.35	5.88	2.94	11.76
9	Manufacture of rubber, rubber products and plastics products	84.38	6.25	3.13	12.50
10	Manufacture of other non-metallic mineral products	91.18	5.88	5.88	11.76
11	Manufacture of basic metals	84.21	15.79	0.00	21.05
12	Manufacture of fabricated metal products, computer, and optical products, and electrical equipment	85.29	5.88	2.94	11.76
13	Manufacture of machinery and equipment	85.00	10.00	5.00	15.00
14	Manufacture of transport equipment	87.88	6.06	3.03	12.12
15	Manufacture of furniture	88.24	5.88	2.94	11.76
16	Other manufacturing, repair and installation of machinery and equipment	88.24	5.88	2.94	11.76
D. Electricity and Gas		82.35	14.71	38.24	20.59
1	Electricity	67.65	14.71	38.24	17.65
2	Manufacture of gas and production of ice	82.35	5.88	17.65	17.65
E. Water supply, sewerage, waste management and remediation activities		79.41	11.76	26.47	17.65
F. Construction		79.41	8.82	0.00	14.71
G. Wholesale and retail trade; repair of motor vehicles and motorcycles		82.35	2.94	8.82	17.65
1	Wholesale and retail trade and repair of motor vehicles and motorcycles	79.41	2.94	8.82	14.71
2	Wholesale trade and retail trade except of motor vehicles and motorcycles	79.41	2.94	2.94	17.65
H. Transportation and storage		91.18	8.82	8.82	14.71
1	Railways transport	70.00	0.00	10.00	20.00
2	Land transport	88.24	5.88	2.94	14.71

Industry		Percentage of Provinces by Source of Data Used (%)			
		BPS	ministries/ agencies/ institutions	Company reports	Others
(1)		(2)	(3)	(4)	(5)
3	Sea transport	87.88	3.03	0.00	12.12
4	River, lake, and ferry transport	84.85	6.06	0.00	12.12
5	Air transport	88.24	2.94	5.88	14.71
6	Warehousing and support services for transportation, postal and courier	88.24	5.88	2.94	14.71
I. Accommodation and food and beverage service activities		94.12	2.94	0.00	14.71
1	Accommodation	88.24	2.94	0.00	14.71
2	Food and beverage service activities	94.12	2.94	0.00	14.71
J. Information and communication		88.24	2.94	2.94	17.65
K. Financial and insurance activities		88.24	8.82	2.94	14.71
1	Financial intermediary services	85.29	8.82	2.94	14.71
2	Insurance and pension fund	85.29	8.82	2.94	14.71
3	Other financial services	82.35	8.82	2.94	14.71
4	Financial supporting services	82.35	5.88	2.94	14.71
L. Real estate		85.29	2.94	2.94	14.71
M,N. Business activities		88.24	2.94	2.94	14.71
O. Public administration and defence; compulsory social security		79.41	11.76	0.00	11.76
P. Education		91.18	8.82	2.94	14.71
Q. Human health and social work activities		94.12	11.76	2.94	14.71
R,S,T,U. Other services activities		91.18	2.94	2.94	14.71

7. Furthermore, an identification of the strength of data and indicator is also conducted. This is to see to what extent the data or indicator for compiling GRDP of regencies and cities is available. The strength of data sources is grouped into 3 types, namely:

- Basic (Main) Data Available: The strength of data in this classification is based on the availability of production/income data on a quarterly basis at the regency/city level.
- Indicator Data Available: The strength of data in this classification is based on the absence of basic or main production/income data on a quarterly basis at the regency/city level. However, there are related production indicators available on a quarterly basis at the regency/city level, such as the number of workers, export of goods, tourist arrivals, household consumption, and restaurant taxes. This

classification also includes the use of processed sample data from quarterly surveys that cannot be used to estimate up to the regency/city level, such as the Special Quarterly Production Accounts Survey for Goods and Services (SKTNP).

- **Data and Indicators Not Available:** The strength of data in this classification indicates the absence of production data and indicators on a quarterly basis at the regency/city level, thus the compilation of GRDP is estimated from data/indicators on an annual basis or from data/indicators at the provincial/national level. This classification also includes the compilation of GRDP by industry that are solely based on phenomena or statistical modeling.

8. The results of the identification of the strength of data sources/production indicators for the compilation of quarterly GRDP by industry are shown in Table 3:

Table 3
Strength of data sources by industry

Industry		Percentage of Regencies and Cities by the strength of data source (%)		
		Basic data available	Indicator data available	Data and indicator not available
(1)		(2)	(3)	(4)
A. Agriculture, forestry and fishing		40.67	14.21	45.12
1a	Food crops	91.19	1.17	7.63
1b	Horticultural crops	76.37	6.25	17.38
1c	Plantation crops	20.32	11.50	68.18
1d	Annual horticultural crops and others	70.57	5.85	23.59
1e	Other plantation	26.88	21.59	51.53
1f	Livestock	28.60	28.02	43.39
1g	Agriculture services and hunting	0.00	24.61	75.39
2	Forestry and Logging	15.67	7.84	76.49
3	Fishery	29.18	20.23	50.58
B. Mining and quarrying		10.77	45.91	43.32
1	Crude petroleum, natural gas, and geothermal	47.30	21.62	31.08
2	Coal and lignite mining	28.07	19.30	52.63
3	Iron ore mining	5.33	21.33	73.33
4	Other mining and quarrying	4.90	60.20	34.90
C. Manufacturing		7.11	25.53	67.36
1a	Manufacture of coal	14.29	0.00	85.71
1b	Manufacture of refined petroleum products	17.95	35.90	46.15
2	Manufacture of food products and beverages	10.12	52.14	37.74

Industry		Percentage of Regencies and Cities by the strength of data source (%)		
		Basic data available	Indicator data available	Data and indicator not available
(1)		(2)	(3)	(4)
3	Manufacture of tobacco products	16.02	23.20	60.77
4	Manufacture of textiles; and wearing apparel	6.37	32.87	60.76
5	Manufacture of leather and related products and footwear	11.70	15.85	72.45
6	Manufacture of wood and of products of wood and cork, and articles of straw and plaiting materials	6.07	28.38	65.56
7	Manufacture of paper and paper products, printing and reproduction of recorded media	5.82	21.83	72.35
8	Manufacture of chemicals and pharmaceuticals and botanical products	7.06	20.31	72.63
9	Manufacture of rubber, rubber products and plastics products	8.29	26.24	65.47
10	Manufacture of other non-metallic mineral products	6.28	22.47	71.26
11	Manufacture of basic metals	11.35	19.15	69.50
12	Manufacture of fabricated metal products, computer, and optical products, and electrical equipment	5.17	18.75	76.08
13	Manufacture of machinery and equipment	3.43	12.25	84.31
14	Manufacture of transport equipment	4.91	17.06	78.04
15	Manufacture of furniture	6.20	30.00	63.80
16	Other manufacturing, repair and installation of machinery and equipment	5.35	20.37	74.28
D. Electricity and Gas		30.51	25.05	44.44
1	Electricity	56.13	18.77	25.10
2	Manufacture of gas and production of ice	3.72	31.61	64.67
E. Water supply, sewerage, waste management and remediation activities		52.78	36.71	10.52
F. Construction		0.97	56.81	42.22
G. Wholesale and retail trade; repair of motor vehicles and motorcycles		2.63	36.90	60.47
1	Wholesale and retail trade and repair of motor vehicles and motorcycles	0.58	39.77	59.65

Industry		Percentage of Regencies and Cities by the strength of data source (%)		
		Basic data available	Indicator data available	Data and indicator not available
(1)		(2)	(3)	(4)
2	Wholesale trade and retail trade except of motor vehicles and motorcycles	4.67	34.05	61.28
H. Transportation and storage		15.38	32.20	52.42
1	Railways transport	23.73	48.31	27.97
2	Land transport	0.78	30.86	68.36
3	Sea transport	33.74	41.15	25.10
4	River, lake, and ferry transport	17.97	25.42	56.61
5	Air transport	60.44	25.27	14.29
6	Warehousing and support services for transportation, postal and courier	1.76	31.96	66.27
I. Accommodation and food and beverage service activities		10.17	64.81	25.02
1	Accommodation	20.20	64.71	15.10
2	Food and beverage service activities	0.19	64.91	34.89
J. Information and communication		0.19	21.44	78.36
K. Financial and insurance activities		3.20	20.03	76.77
1	Financial intermediary services	11.13	17.19	71.68
2	Insurance and pension fund	0.00	21.15	78.85
3	Other financial services	0.40	27.15	72.46
4	Financial supporting services	0.25	13.38	86.36
L. Real estate		7.00	24.90	68.09
M,N. Business activities		2.54	32.42	65.04
O. Public administration and defence; compulsory social security		55.06	40.27	4.67
P. Education		5.06	63.23	31.71
Q. Human health and social work activities		3.50	61.48	35.02
R,S,T,U. Other services activities		5.84	47.67	46.05
Overall		16.66	29.90	53.44

9. Based on the recapitulation of data source strength above, it is shown that the strength of data sources varies across industries. Most industries are not supported by strong data or indicators. Only a few industries have the availability of basic data on a quarterly basis down to the regency/city level, namely: Food crops (A.1.a); Horticultural crops (A.1.b); horticultural crops and others (A.1.d); Crude petroleum, natural gas, and geothermal mining (B.1); Electricity (D.1); Water supply, sewerage, waste management and remediation activities (E); Air transport (H.5); and, Public administration and defence; compulsory social security (O).

B. Calculation methodology

10. The study on compiling quarterly GRDP of regencies and cities consists of benchmarking the annual GRDP data to quarterly for the period of 2018 – 2022, followed by estimating the GRDP of regencies and cities for Quarter I and II year 2023. The study involves BPS' staffs in the 514 regional BPS offices. Due to resource and time constraints, staff from the headquarters and provincial BPS offices assisted in compiling the quarterly GRDP for regencies.

1. Benchmarking Annual GRDP to Quarterly GRDP for Regencies and Cities

Benchmarking is a procedure aimed at ensuring that quarterly data is consistent with annual data. This is based on the assumption that annual estimates are considered superior to quarterly estimates, given that annual data is usually more comprehensive and accurate compared to quarterly data.

The benchmarking process can involve interpolating annual data to construct a "back series" or extrapolating to produce quarterly estimates when annual data is not yet available ("forward series"). The benchmarking process must preserve as much as possible the movements of the original indicators, with the given constraints. In the case of interpolation, the number of data points for the 4 quarters must match the annual data. In the case of extrapolation, the forward series estimates should closely resemble the unknown annual data. For some cases where the availability of quarterly data is sufficiently good, the benchmarking procedure is not required.

The benchmarking principle is based on a measure called the Benchmark-to-Indicator (BI) Ratio. The BI Ratio can be used to identify whether the movement of benchmarked data aligns with its indicators. The BI Ratio is formulated as follows:

$$BI\ Ratio = \frac{B_t}{I_t}$$

where:

B_t is the benchmark result for period t; and

I_t is an indicator in period t.

The benchmarking process of quarterly GRDP conducted by most provinces utilizes the Denton Proportional Method. The principle of the Denton method is to maintain the BI Ratio as stable as possible within given constraints. Benchmarking using the Denton Proportional Method is carried out by minimizing the function:

$$\sum_{t=2}^q \left[\frac{B_t}{I_t} - \frac{B_{t-1}}{I_{t-1}} \right]^2$$

within the constraint of $\sum_{4=4n-3}^{4n} B_t = A_n$ for $n = 1, \dots, y$

where:

B_t is the quarterly estimate level for quarter t;

I_t is the quarterly indicator level for quarter t;

A_n is the annual estimated level for the year n;

n is the time index for the year;
 t is the time index for the quarter; and
 y is the last year of available data.

In the Denton method, changes in the BI Ratio between years are smoothed to minimize sudden changes during the transition of years. Thus, the Denton method can reduce the "step problem." Growth in Denton results also tends to align with the growth of the original indicator. However, not all provinces use the Denton method in compiling quarterly GRDP. The Riau Archipelago Province and the Special Region of Yogyakarta use indirect methods in compiling quarterly GRDP for the period 2018-2022. Some other provinces also use different methods, East Java province for instance, applying allocation methods; North Kalimantan, conducting benchmarking studies of GRDP of regencies and cities; and, North Sulawesi, utilizing pro rata adjustment methods.

2. Estimating Quarterly GRDP of Regencies and Cities for The Current and Subsequent Periods

Methods to estimate quarterly GRDP of regencies and cities for 2023 period are carried out through two methods, namely Direct Method, and Indirect Method. The direct method is a calculation method using data sourced from each region. Using the direct method, quarterly GRDP of regencies and cities can be measured by three different approaches: production, income, and expenditure approach. The production approach measures the value added of goods and services produced by all economic activities by subtracting intermediate costs from each gross production value of each industry. In the income approach, the value added of each economic activity is measured by summing up all factor income payments, namely labor compensation, business surplus, consumption of fixed capital, and taxes minus other subsidies on production. Lastly, the expenditure approach focuses on the final use of goods and services within the regencies/cities.

The indirect method is a calculation method using allocation, which allocates Provincial GRDP into Regency/City GRDP using various production indicators or other suitable indicators as allocators. One assumption used in the allocation method is the availability of good Provincial GRDP data. Without good Provincial GRDP data, the results of the allocation method for districts/cities will not be satisfactory.

3. Calculating Quarterly GRDP of Regencies and Cities at Constant Price

Quarterly GRDP of regencies and cities at constant price can be obtained through revaluation, extrapolation, deflation, and double deflation methods. In the revaluation method, output at constant prices is calculated by multiplying the current quarter's production quantity by the base year prices. In the extrapolation method, the output at constant prices is calculated by multiplying the value of output at base year current prices by a production index. In the deflation method, the output at constant prices is calculated by dividing the current quarter value by a price index. Lastly, in the double deflation method, both output at constant prices and intermediate consumption at constant prices are calculated by dividing the current quarter value by a price index.

III. Results

11. The activity of compiling quarterly GRDP of regencies and cities results in the quarterly GRDP by industry of 514 regencies and cities of Indonesia, comprising of 17 categories of industries, from the first quarter of 2018 to the second quarter of 2023. After reconciling quarterly GRDP between Provincial GRDP and regency/city GRDP, discrepancies were still found as shown in Table 4.

Table 4

Average of (Absolute) Discrepancy between provincial and regency/city GRDP

Period	Average of absolute discrepancy (percentage)	
	GRDP at current price	GRDP at constant price
(1)	(2)	(3)
Q1 - 2018	0.73	0.73
Q2 - 2018	0.70	0.65
Q3 - 2018	0.68	0.58
Q4 - 2018	0.68	0.66
Y - 2018	0.54	0.56
Q1 - 2019	1.10	0.93
Q2 - 2019	0.74	0.70
Q3 - 2019	0.70	0.70
Q4 - 2019	0.75	0.77
Y - 2019	0.57	0.65
Q1 - 2020	1.36	1.34
Q2 - 2020	0.98	0.96
Q3 - 2020	1.00	0.81
Q4 - 2020	0.76	0.68
Y - 2020	0.53	0.62
Q1 - 2021	1.30	1.25
Q2 - 2021	0.85	0.78
Q3 - 2021	0.68	0.73
Q4 - 2021	0.70	0.69
Y - 2021	0.49	0.60
Q1 - 2022	1.03	0.70
Q2 - 2022	0.77	0.87
Q3 - 2022	0.57	0.75
Q4 - 2022	0.73	0.64
Y - 2022	0.47	0.66
Q1 - 2023	1.59	1.19
Q2 - 2023	3.80	2.20

12. Based on the table 4, it can be seen that the average discrepancy between quarterly provincial GRDP and quarterly GRDP of regencies and cities is mostly less than 1 percent. In the reconciliation phase, BPS set a limit that the total discrepancy of GRDP should be less than 5 percent and the discrepancy at the category level should be less than 7 percent. Although on average, the total discrepancy of GRDP both at current prices and constant prices is below 5 percent, when viewed by province, there are still 6 provinces that have not met the requirement of total GRDP discrepancy, namely West Java, Central Kalimantan, West Sulawesi, DKI Jakarta, Riau Archipelago, and Papua. West Java Province still has a discrepancy above 5 percent for the first quarter of 2019, Central Kalimantan Province still has a discrepancy above 5 percent for the first quarter of 2019-2023, West Sulawesi Province still has a discrepancy above 5 percent for the second and third quarters of 2020, DKI Jakarta Province still has a discrepancy above 5 percent for the first and second quarters of 2023, while Riau Archipelago Province and Papua Province still have a discrepancy above 5 percent in the second quarter of 2023.

IV. Conclusion

13. The compilation of quarterly GRDP of 514 regencies and cities of Indonesia by industry relies significantly on the availability of data and indicators from BPS alongside ministries/agencies/institutions. While data on production primarily stems from BPS and ministries/agencies/institutions, certain industry subcategories still lack sufficient support from these sources. Meanwhile, all price data and indicators utilize data from BPS. Addressing the data deficit requires strengthened collaboration between BPS and relevant ministries/agencies/institutions so that it can obtain comprehensive data for all necessary categories/subcategories essential for calculating quarterly GRDP of 514 regencies and cities of Indonesia.

14. Additionally, beyond the focus on data evaluation as an asset, another critical challenge is the limited number of qualified personnel and their understanding on national accounting, particularly within the BPS offices at the regency/city level. Therefore, facilitating capacity-building initiatives is expected to significantly enhance competency in compiling quarterly regency/city GRDP by industry.

15. The study reveals that most provinces use the Denton Proportional method for benchmarking quarterly GRDP for regencies and cities by industry for the 2018-2022 estimates. Some provinces utilize alternative methods such as the indirect approach, allocation method, and pro-rata adjustment. Notably, despite the widespread use of the Denton method, benchmarking outcomes for certain categories/subcategories may still exhibit suboptimal data patterns, often influenced by the selection of benchmarking indicators.

16. In general, the reconciliation process between provincial GRDP and regencies/cities GRDP has been useful in minimizing discrepancies between provincial GRDP and the total regencies/cities GRDP. The discrepancy can be eliminated by narrowing the limitations in the future work.

17. The study was conducted within a relatively short timeframe, which posed challenges given the involvement of human resources from regional BPS offices (regencies and cities). It is essential to recognize that these individuals are often engaged in various tasks, which limited the time available to complete the study. Consequently, the allocated time for compiling the quarterly GRDP of regencies and cities was deemed insufficient, warranting consideration for an extension.

18. Policymakers' demand for rapid economic indicators to inform tailored policies for each regency and city underscores the importance of this study. While acknowledging the study's imperfections and limitations highlighted throughout the paper, it remains a valuable foundation for future refinement and improvement.
