

A stylized blue globe is the central background element, showing the outlines of continents. Overlaid on the globe is a complex network of thin white lines connecting numerous small white dots, representing a global communication or postal network. The dots are more densely packed in some areas, particularly around the equator and in the Atlantic and Indian Oceans.

Postal Development Report 2019

Perspectives on the
performance of postal
operators worldwide

October 2019



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Postal Development Report 2019

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Glossary

2IPD	Integrated Index for Postal Development
GDP	Gross Domestic Product
DO	Designated Operator
EDI	Electronic Data Interchange
EMS	Express mail service
EMSEVT	EMS item event
ITU	International Telecommunication Union
PREDES	Pre-advice of dispatch
PTC	Postal Technology Centre
PPP	Purchasing Power Parity
SDGs	Sustainable Development Hoals
USD	United States dollar
WDI	World Development Indicators

1. Introduction

Postal development

The postal sector plays an important role in promoting socio-economic development.ⁱ Affordable, efficient and universal postal services substantially reduce transaction costs between economic agents, granting them access to a vast communications and infrastructure network. In this sense, the postal sector actively contributes to the achievement of the United Nations Sustainable Development Goals (SDGs). The present report monitors and benchmarks the situation of postal development around the world as of 2019.

Postal development can be defined as the ability of a country's postal network to perform on a wide range of factors that enable socio-economic development. In this regard, postal networks can be considered as high performing if they offer a reliable service, and have good connectivity, a high level of demand from citizens, and operations that are resilient to external shocks.

The Integrated Index for Postal Development (2IPD) encapsulates this definition and provides policy makers, regulators and operators with tools to assess a country's level of postal development.

By drawing on a wide range of (big) data from numerous sources, the 2IPD provides a composite picture of postal development in over 170 countries, with a ranking that focuses on the performance of traditional postal operators. Historically, these operators have been considered as primarily vehicles for delivering socio-economic development, representing one of the largest physical networks in the world, with 668,445 post offices and 5.26 million employees.ⁱⁱ

Top performers

Switzerland continues to top the ranking, followed by the Netherlands, Germany, Japan and France; the top 10 is now exclusively made up of advanced economies.

As in previous years, there are, of course, encouraging results among regional leaders, such as Poland, China (People's Rep.), Tunisia, Colombia and Nigeria.

Development gaps

One of the main findings of the report is that development gaps between countries have continued to widen. Indeed, while some postal operators have been remarkably successful, others are lagging behind. In most regions, there has been an increase in the mean spread compared to the 2018 2IPD ranking.

These gaps pose a considerable threat to the development of e-commerce, and they are a hurdle on a promising avenue for future growth.

The report finds that reducing postal development gaps might yield gains at the bilateral level, as measured by bilateral exchanges of parcel post. In particular, each 1% reduction in the differential of 2IPD scores is associated with a 0.1% increase in bilateral parcel tonnage.

A roadmap for development

The takeaway is clear-cut; the appropriate strategy to achieve it less so. The report presents evidence that, while reducing gaps within regions is important, the strongest effects are in terms of reductions at the global level. Thus, the roadmap for postal development needs to be a global one, highlighting the important role of developing multilateral solutions.

Structure of this report

This report is structured in five sections: after the present introduction, the second section provides details on how the 2IPD is constructed; the third presents the results of the 2019 2IPD ranking; the fourth section studies the consequences of reducing development gaps on international e-commerce, in particular on parcel flows; and the fifth section draws conclusions.

2. The 2IPD

Four pillars of postal development

The 2IPD is a comparative indicator of postal development around the world.ⁱⁱⁱ It is a composite index that summarizes information about the performance of postal operators in over 170 countries. As such, the 2IPD is a unique tool for analyzing the state of the postal sector. Thanks to its wide geographic coverage and the depth of its underlying data, this index appeals to a multitude of stakeholders.

The 2IPD is built on four pillars, which in turn are sustained by a variety of sub-indicators:

- **Reliability** reflects performance in terms of speed and predictability of delivery, across all the key segments of physical postal services (letter post, parcel post and express);
- **Reach** synthesizes global connectivity by evaluating the breadth and depth of the postal operators' international network. The number of partner networks and the volumes of international exchanges measure these, respectively, across all the key segments of physical postal services;
- **Relevance** measures the intensity of demand for the full portfolio of postal services relative to the best performers in each category of postal activity, also taking into account elements such as the number of international transactions and the number of post offices;
- **Resilience** indicates the level of diversification of revenue streams and the capacity to innovate, deliver inclusive postal services, and integrate sustainable development targets into postal business operations.

The purpose of the reliability score is to measure operational efficiency of postal services, while reach captures the level of internationalization of these operations. When it comes to relevance, the key goal is to evaluate the competitiveness of postal services in all key segments, and in particular the potential to generate higher volumes. Regarding the resilience score, the intent is to assess the ability of postal services to withstand external shocks through adaptable business models.

Overall, these four pillars are aimed at providing a balanced view of postal development, without solely focusing on operational (e.g. delivery), strategic (e.g. business portfolio management) or societal matters (e.g. financial inclusion). This enables the final score to comprehensively reflect (while succinctly expressing) the situation of postal services in any given geography.

The input is then integrated into an algorithm, which yields a general score between 0 and 100 for each assessed country.

The data sustaining the pillars

The 2IPD draws on the following types of UPU data:

- UPU postal big data (over 22.9 billion records since 2013);
- Official UPU postal statistics (more than 100 indicators available in 2017) and UPU surveys.

The first type is used mainly to compute indicators associated with quality of service, transactions, volumes and connectivity. It feeds the reliability and reach pillars. The second type applies to the measurement of revenue streams, economies of scale, infrastructure and financial inclusion.

Every year, the best postal development performer obtains a normalized maximum score of 100, while the worst gets a minimum of 0. In this sense, the normalized scores can be read as the distance of any given country compared to the best (score of 100) or worst (score of 0) global performer. This enables any country to assess whether it is closer to the best, intermediate or worst absolute performer.

Comparing postal development around the globe

Given the statistical distribution of the 2IPD scores, it is possible to categorize countries in four main categories (see Figure 1)^{iv}:

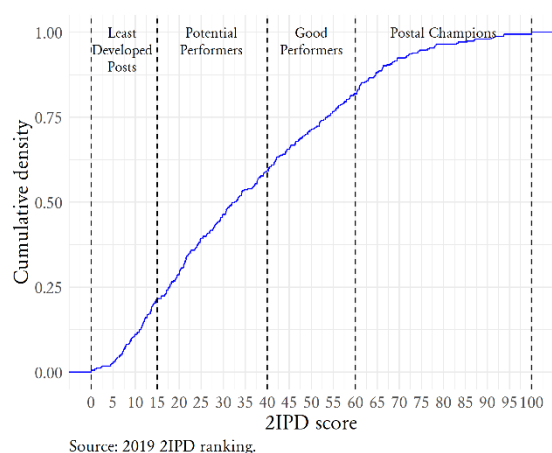
- **Postal champions:** A score above 60 shows that a country's postal development is among the top 20% in the world – a performance which can be considered very good to outstanding. This group of countries can be denoted as having a well-balanced performance across all pillars of postal development.

- **Good performers:** A score between 40 and 60 shows an upper-intermediate level of performance. These countries are consistent performers which belong to the top 40%.
- **Potential performers:** A score between 15 and 40 shows lower than average level of performance, with countries usually performing only partially well, albeit with a high development potential. Nevertheless, most countries in this group exhibit glaring weaknesses in one or more areas of postal development.
- **Least developed operators:** A score below 15 shows that a country's postal development is very low. These countries are facing important challenges in several of the key pillars of postal development.

above (i.e. postal champions, good performers, potential performers and least developed operators). Movements in the ranking within a category are much more likely than between categories. For instance, turning a least developed operator into a good performer will usually require a substantial transformation, and will most likely take years of conscious and continuous improvement initiatives.

Further details on the methodology used to calculate the 2IPD are available in Appendix 2.

Figure 1 Cumulative distribution, 2019 2IPD



Since the 2IPD is a comparative index, the interpretation of the scores has to take into account two important elements:

First, the scores are of a relative nature. Thus, the position of a given country is determined by its performance relative to its peers. If a country makes absolute progress on a specific dimension of the 2IPD, this will have an impact on the final ranking if and only if its peers have not made even greater gains in performance.

Second, the position of a country in the global ranking should preferably be considered in conjunction with the regional standing and its economic development level. In this sense, it may be unrealistic to expect countries to be the postal champions if most of their regional peers are struggling.

Third, performance is more adequately evaluated within one of the four main categories mentioned

3. The 2019 2IPD ranking

Overview of the 2019 Integrated Index for Postal Development

For the third year in a row, the Universal Postal Union is releasing the 2IPD ranking. The 2019 results covers 172 countries (see Table 1 for the full ranking).

In 2019, the worldwide average for the ranking is 35, with a score of 72.88 required to enter the top 10, compared to 76 in 2018.

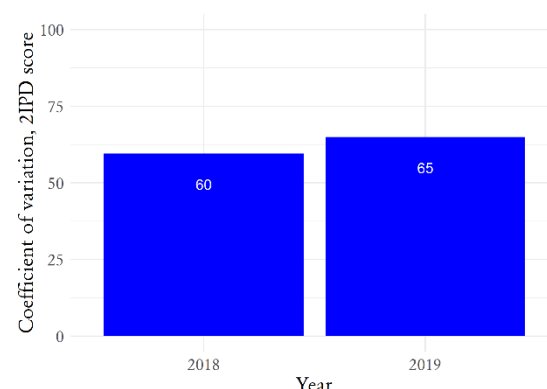
Switzerland, the Netherlands and Germany top the list, followed by Japan and France. These countries have achieved a high level of performance thanks to a strong showing across the four areas of postal development.

The overall ranking shows much heterogeneity geographically (see Figure 3), with a higher level of dispersion in 2019 than in 2018.

Growing postal development gaps

The coefficient of variation, a measure of dispersion with respect to the mean depicted in Figure 2, was 59.5% in 2018. In 2019, the figure increased to 64.9%. This suggests that postal development is evolving according to different patterns in each country and certainly not at the same speed, deepening the gaps between the top performers and the rest.

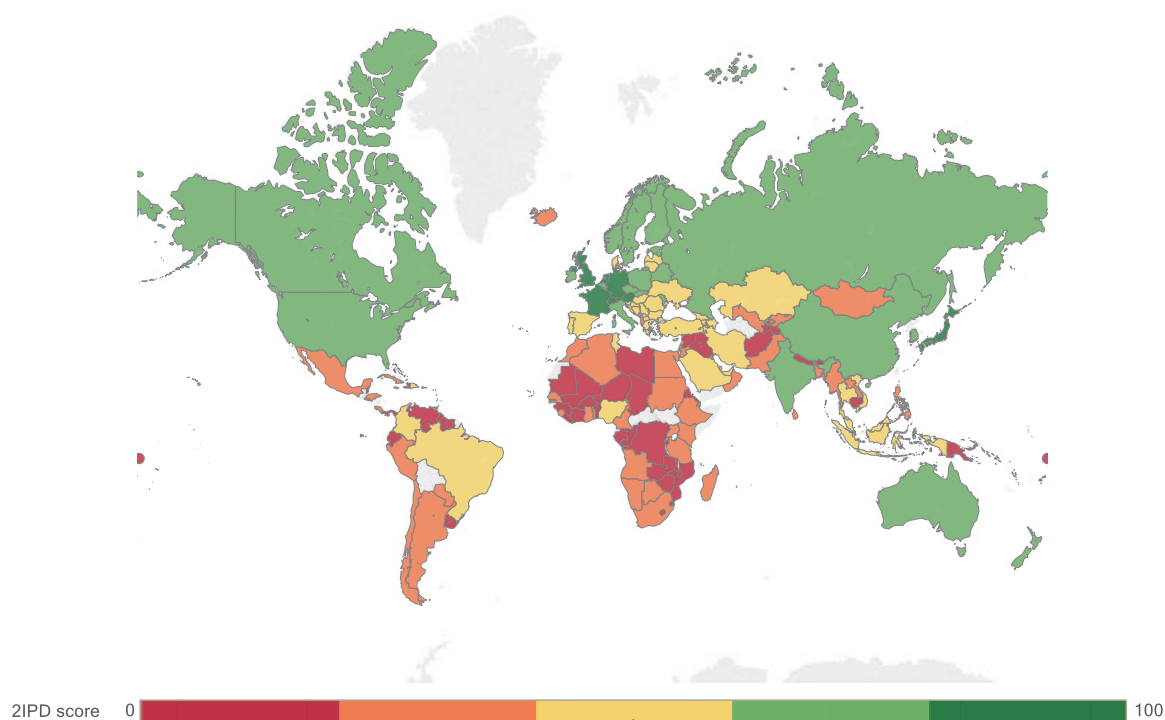
Figure 2 Increased dispersion in the 2IPD ranking



Source: 2018 and 2019 2IPD ranking.

Notes: The coefficient of variation is the ratio between the standard deviation and the mean of the overall 2IPD score.

Figure 3 2019 2IPD



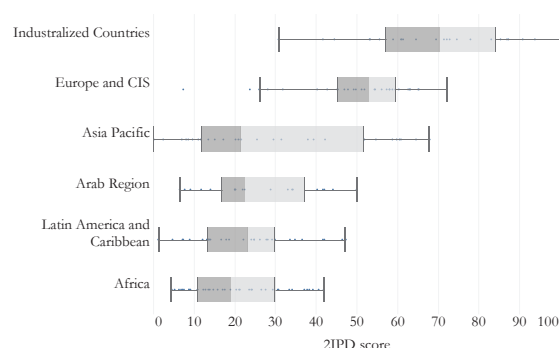
Source: 2019 2IPD ranking.

Notes: The five colours represent scores in the intervals 0–20, 20–40, 40–60, 60–80 and 80–100. This map was produced by staff of the UPU; the boundaries, colours and any other information on this map do not imply, on the part of the UPU, any judgement on the legal status of any territory, or any endorsement or acceptance of such boundaries.

The group of industrialized countries is the region with the highest average (68.9), followed by Europe and CIS (49.8), Asia-Pacific (29.5), the Arab region (27.29), Latin America and the Caribbean (22.7), and Africa (20.6).

Yet the regional situation is more complex than these averages suggest. In fact, there is considerable dispersion within the regions, as can be seen from Figure 4. Each region has its own complexities and should be considered individually.

Figure 4 Within-region dispersion



Source: 2019 2IPD ranking.
Notes: Box plots by region, sorted from highest to lowest average value of the 2019 2IPD score. Regional categories defined in the appendix.

Industrialized countries top the 2019 ranking

For the first time since its inception, the top 10 of the 2IPD ranking is composed exclusively of industrialized countries.^v This is the most homogeneous group, with a dispersion of the score relative to the regional mean of 26%. The spread of rankings is also the smallest, ranging from 86th to first place. Currently the region has the highest level of postal development, with small inequalities between the countries.

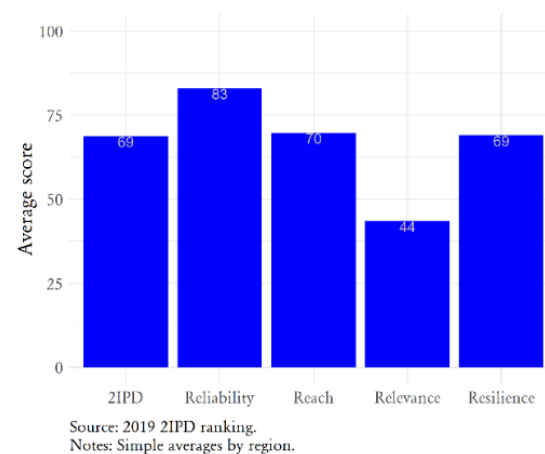
Switzerland has retained the top spot of the ranking, once again improving its relative performance worldwide. It has not only achieved a score of 100 in relevance and resilience but it also improved both its reliability and reach scores.

In second place, the Netherlands has consolidated its position. This has been achieved through increased quality of service and reach, by 4% and 10% respectively.

One major change in the ranking has been the rise of Germany, which now occupies the third place, formerly held by Japan. The change was

due to an increase in the reliability and reach scores of Germany.

Figure 5 Overview: Industrialized countries



While the top five countries have maintained their scores, some countries like Austria and the United Kingdom have witnessed a change greater than the average, with an improvement in relevance and resilience allowing them to climb up the ranking. In addition, Canada has entered the top 10 by gaining five places, thanks to an increase in its relevance score.

Currently the strengths of the region are in the reliability and reach pillars. In other words, industrialized countries are characterized by fast and predictable deliveries, as well as well-connected networks.

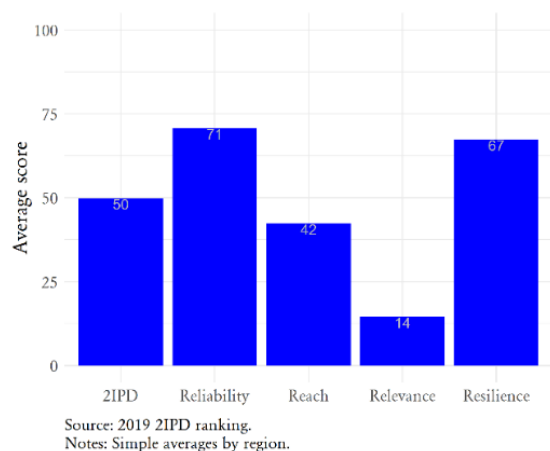
While all pillars are well above the global average, the weakest pillar for industrialized countries appears to be relevance, which is currently a worldwide concern for the sector.

Eastern Europe and CIS continues to be a bastion of postal development

Eastern Europe and CIS is the region with the second highest average (49.8). In spite of the diversity of countries represented in this group, we observe that it is a very homogeneous region with a coefficient of variation for the 2IPD score of 29%.

In 2019, the top regional spot is once again held by Poland, in spite of a deterioration in its own score and global ranking (-5 places since 2018). Currently, the strengths of the region are in reliability and resilience, whereas the greatest disparities are to be found in reach and relevance.

Figure 6 Overview: Europe and CIS

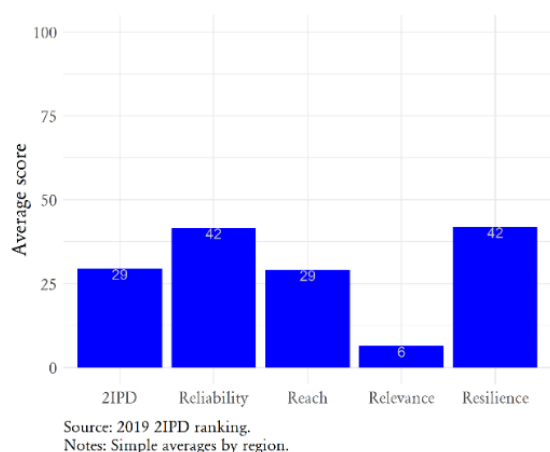


Asia-Pacific constitutes a major development region, with contrasting realities

Asia-Pacific is the most heterogeneous region in terms of postal development. In 2019, it had the highest degree of dispersion around the mean: close to 73% around the regional average of 29. These great disparities can be seen by the contrasts between top regional performers such as China (People's Rep.), Singapore and India, and the challenges faced by smaller states (e.g. Papua New Guinea, Tuvalu and Samoa).

The sheer differences in economic size seem to be one of the key drivers for the variation in the degrees of postal development in this group of countries. Thus, the averages presented in the figure below are not exhaustive in describing the current regional landscape.

Figure 7 Overview: Asia-Pacific



The change at the top of the regional list has resulted from China (People's Rep.) consolidating its 15th place and Singapore

slipping out of the global top 10. Postal growth in the region has mostly stagnated in the past year.

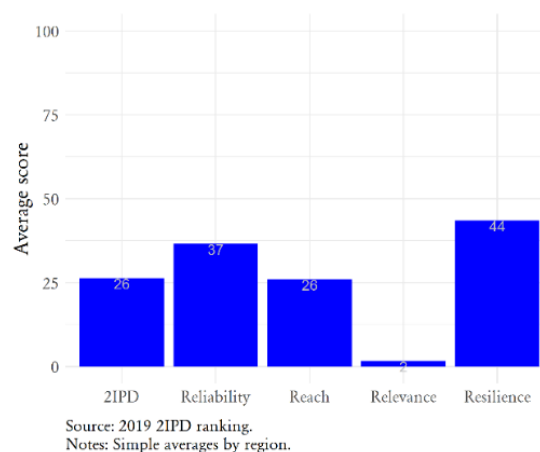
Many countries in the Arab region have seen progress in their scores

Most countries in the Arab region performed better than in the previous year. As shown in the Postal Economic Outlook 2019^{vi}, postal growth in the region has outperformed the real economy in recent years. This might be translating into greater postal development opportunities in Arab countries.

Tunisia has retained the top regional spot (47th globally), followed by the United Arab Emirates. The 2019 ranking reveals once again the presence of great disparities within the region. While Tunisia and the UAE occupy the 47th and 57th global spot, Syria, Iraq and Libya are all ranked after the 150th place.

While the weight of the geopolitical situation on the least developed operators of the region cannot be ignored, there is a significant potential for future postal development in this group of countries.

Figure 8 Overview: Arab region

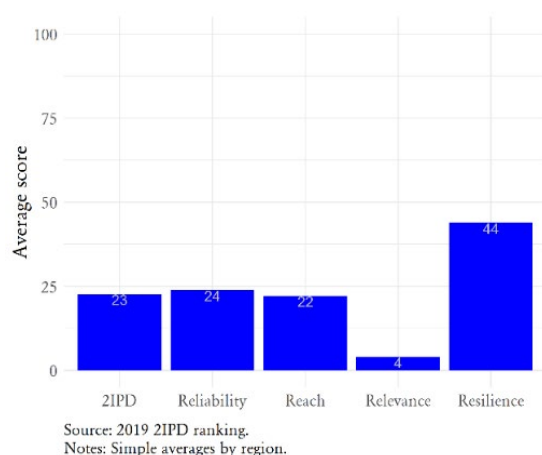


Indeed, as capital investments, policy reforms and tourism activity lift growth in 2020–2021, the postal sector should be able to benefit.^{vii} The region presents significant opportunities to postal operators for growth in e-commerce-related activities. It is, in fact, the third least digitalized region in the world, meaning that additional Internet connectivity is likely and would potentially further reinforce e-commerce growth.

Latin America and the Caribbean

In Latin America and the Caribbean, Colombia has recorded its highest ever score (51st place), taking the top regional spot. It has thus overtaken Brazil, the former regional leader, whose performance has deteriorated, with a drop of eight places in the global ranking, owing to a significant deterioration in the speed and predictability of delivery. In fact, the whole region still suffers from structural problems in terms of reliability. It is one of the regions with the greatest dispersion rate in this pillar, as well as one of the lowest average reliability scores.

Figure 9 Overview: Latin America and the Caribbean



Africa

Africa has seen a drop in its average score, although some countries continue to make progress. Nigeria has retained the top regional spot, closely followed by Mauritius and Tanzania (United Rep.). These countries have achieved good performance thanks to scores well above the regional average. Tanzania (United Rep.), Senegal and Ethiopia have seen large boosts to their rankings, rising 22, 26 and 34 places, respectively. This trio of countries has significantly increased its quality of service, resulting in consequential changes in reliability scores.

Figure 10 Overview: Africa

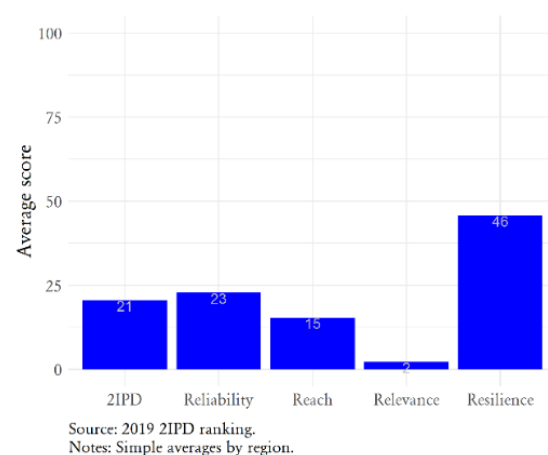


Table 1 ZIPD 2019 ranking

Rank	Country	ZIPD 2019	Change	Rank	Country	ZIPD 2019	Change
1	Switzerland	100.00	+0.00	44	Turkey	51.79	-3.45
2	Netherlands	93.67	-0.03	45	Viet Nam	51.79	+0.06
3	Germany	90.79	-0.49	46	Georgia	51.13	-2.43
4	Japan	87.19	-4.41	47	Tunisia	50.00	-1.90
5	France	86.86	+3.52	48	North Macedonia	49.72	+2.37
6	Austria	85.34	+9.04	49	Kazakhstan	49.14	-3.72
7	United Kingdom	82.93	+6.15	50	Romania	47.81	-0.20
8	United States of America	77.92	+0.03	51	Colombia	47.22	+3.11
9	Canada	74.55	+5.03	52	Azerbaijan	46.99	-3.51
10	New Zealand	72.88	-1.28	53	Brazil	46.33	-7.66
11	Poland	72.18	-6.10	54	Bosnia and Herzegovina	45.35	-10.45
12	Belgium	72.06	+9.95	55	Latvia	45.23	-9.53
13	Italy	71.35	+8.48	56	Denmark	44.50	+0.31
14	Ireland	69.45	+1.15	57	United Arab Emirates	44.19	-2.17
15	China (People's Rep.)	67.82	-1.65	58	Malta	42.65	-9.52
16	Russian Federation	65.31	+8.28	59	Indonesia	42.12	-4.35
17	Czech Rep.	64.97	-1.23	60	Lebanon	42.08	-0.88
18	Singapore	64.57	-13.63	61	Jamaica	42.07	+0.58
19	Sweden	64.55	-2.52	62	Nigeria	41.88	-8.97
20	Slovakia	63.05	-5.82	63	Luxembourg	41.69	-4.56
21	Belarus	62.95	+2.10	64	Dominican Republic	41.57	+14.55
22	Moldova	62.55	-1.64	65	Qatar	41.57	+3.93
23	Norway	61.34	+1.00	66	Mauritius	40.53	-8.64
24	Finland	60.97	-5.30	67	Armenia	40.27	-8.05
25	Australia	60.88	-3.47	68	Saudi Arabia	40.20	+0.54
26	India	60.82	-5.24	69	Pakistan	39.41	+0.29
27	Korea (Rep.)	60.48	-5.46	70	Tanzania (United Rep.)	39.12	+7.32
28	Estonia	60.26	-11.42	71	Senegal	38.20	+7.77
29	Thailand	59.73	-8.71	72	Philippines	37.93	-6.42
30	Lithuania	59.46	-6.64	73	Ethiopia	37.81	+10.95
31	Israel	58.86	+0.39	74	Ghana	37.08	-2.07
32	Slovenia	58.75	-15.55	75	Mexico	36.51	-1.93
33	Malaysia	58.74	-5.89	76	Chile	34.75	-5.46
34	Bulgaria	57.97	+1.88	77	Jordan	34.18	-3.05
35	Cyprus	57.95	+0.38	78	Kenya	34.14	+0.43
36	Croatia	57.32	-3.83	79	Oman	34.03	+12.65
37	Ukraine	56.11	-4.27	80	Costa Rica	33.54	+1.07
38	Spain	55.54	+6.28	81	South Africa	33.34	+0.00
39	Iran (Islamic Rep.)	54.70	+2.78	82	Morocco	33.08	-12.03
40	Serbia	54.40	-1.12	83	Albania	31.85	-11.65
41	Hungary	54.35	-6.91	84	Sri Lanka	31.38	-5.29
42	Greece	53.20	-3.33	85	Iceland	30.73	-17.86
43	Portugal	53.10	+12.23	86	Madagascar	30.65	-0.30

Rank	Country	2IPD 2019	Change	Rank	Country	2IPD 2019	Change
87	Angola	30.54	+9.32	130	Burkina Faso	14.73	-6.86
88	Honduras (Rep.)	29.82	+7.14	131	Mauritania	13.96	-7.07
89	Lao	29.42	-15.64	132	Suriname	13.95	-0.67
90	Cape Verde	29.34	-1.25	133	Malawi	13.74	-11.04
91	Barbados	29.17	-5.05	134	St. Christopher (Kitts) and Nevis	13.68	+2.37
92	Egypt	28.77	+0.97	135	Aruba	13.63	-3.18
93	Uzbekistan	28.06	-4.89	136	Fiji	13.52	-11.79
94	El Salvador	28.04	-9.66	137	Guyana	13.46	+1.34
95	Paraguay	27.66	+6.66	138	Lesotho	13.44	-0.65
96	Namibia	27.52	-3.76	139	Uruguay	13.10	-6.83
97	Uganda	26.42	-11.22	140	Zimbabwe	12.71	-6.82
98	Peru	26.21	-3.57	141	Benin	12.29	-7.13
99	Montenegro	26.04	-3.29	142	Venezuela (Bolivarian Rep.)	12.07	+0.22
100	Myanmar	25.40	-6.56	143	Vanuatu	11.78	-12.65
101	Cuba	24.79	+6.86	144	Comoros	11.76	+0.47
102	Argentina	24.74	-3.78	145	Kiribati	11.74	-0.97
103	Cameroon	24.17	-13.55	146	Afghanistan	10.97	-10.62
104	Seychelles	24.00	-6.67	147	Chad	10.90	+1.57
105	Bahamas	23.97	+9.66	148	Mali	10.88	-7.08
106	Kyrgyzstan	23.60	+5.88	149	Bhutan	9.61	-12.91
107	Sierra Leone	23.50	+8.86	150	Syrian Arab Rep.	9.07	-2.44
108	Bahrain (Kingdom)	22.50	+4.31	151	Niger	9.04	-0.87
109	Trinidad and Tobago	22.01	-6.12	152	Saint Lucia	8.86	+1.12
110	Kuwait	21.87	+4.78	153	Congo (Rep.)	8.80	-7.09
111	Mongolia	21.65	-19.24	154	Zambia	8.75	+0.92
112	Maldives	21.39	-6.96	155	Brunei Darussalam	8.56	-8.89
113	Togo	21.25	-13.00	156	Solomon Islands	7.93	-4.82
114	Botswana	21.00	-2.72	157	Iraq	7.68	+1.85
115	Tonga	20.91	-16.04	158	Gabon	7.53	-2.82
116	Rwanda (Rep.)	20.40	-6.51	159	Tajikistan	7.37	
117	Bangladesh	20.20	-15.34	160	Saint Vincent and the Grenadines	7.31	+1.86
118	Djibouti	20.18	-1.97	161	Antigua and Barbuda	7.17	-9.92
119	Algeria	20.05	-0.01	162	Eritrea	7.06	-3.40
120	Sudan	20.00	-9.82	163	Papua New Guinea	7.01	-2.81
121	Burundi	19.00	-0.21	164	Gambia	6.78	-6.83
122	Belize	18.65	-5.64	165	State of Libya	6.49	-4.97
123	Panama (Rep.)	17.82	-3.65	166	Mozambique	6.28	+1.33
124	Côte d'Ivoire (Rep.)	17.47	+5.39	167	Guinea	5.22	-0.30
125	Nepal	17.14	-1.11	168	Dominica	4.64	-1.09
126	Democratic Republic of the Congo	17.01	+1.13	169	Liberia	4.43	+2.18
127	Ecuador	16.63	-2.88	170	Tuvalu	2.42	+2.42
128	Swaziland	15.80	-8.93	171	Haiti	1.16	+0.42
129	Cambodia	15.09	-4.02	172	Samoa	0.00	-4.41

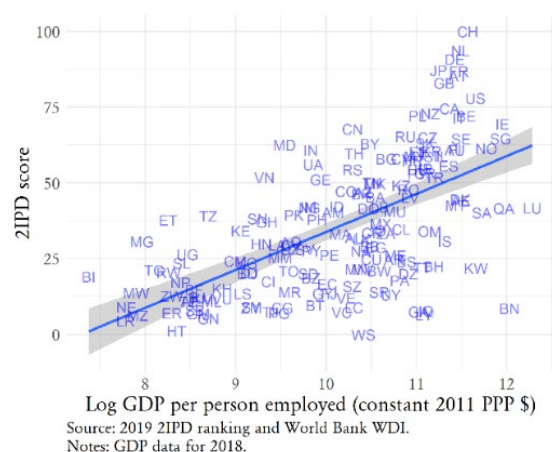
4. Development gaps

Productivity and development gaps

The postal sector is intrinsically linked to socio-economic development. Postal operators supply a variety of services to firms and consumers, ranging from delivery of documents and goods, to payments and citizen services. As is the case with the provision of utility services, access to postal services enables consumers and firms alike to profitably engage in economic activities that would otherwise be overly costly. Therefore, given the nature of its activities, the postal sector is a key element of a nation's economy.

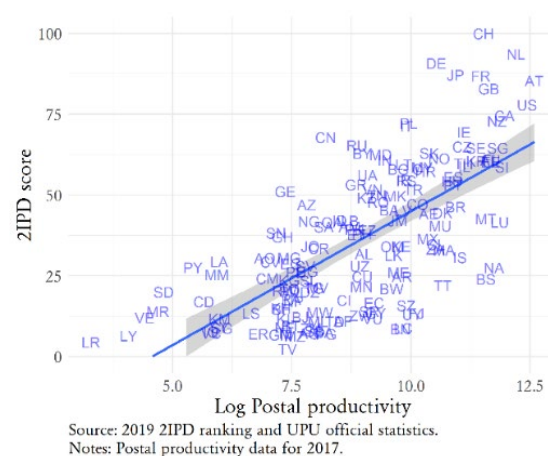
As Figure 11 shows, postal development and productivity are strongly correlated, although there is a significant amount of variability around the relationship.^{viii} The figure suggests that the greater the productivity level of a country, the higher the level of postal development. Countries like Switzerland, the Netherlands and Germany each have a level of postal development that over-performs with respect to the productivity level of their national economies.

Figure 11 Economic productivity and postal development



More narrowly, postal development is also linked with postal productivity, which is defined as the number of mail items per full-time staff member.^{ix} In fact, Figure 12 shows that there is a strong correlation between the two variables. Developed postal operators handle larger volumes and tend to be more productive than less developed ones.

Figure 12 Postal productivity and postal development



Internationalization of postal services and the postal development gap

International postal exchanges have seen a rapid surge in recent years. As international e-commerce grows, the demand for postal services increases. In fact, over the period from 2007 to 2017, exports of international parcels grew at a compounded annual growth rate of 13.3%.^x In spite of the double-digit trend, international exchanges represent only roughly 1% of the volumes transported in domestic markets.^{xi} It is therefore important to consider what role, if any, postal development gaps play in enabling international e-commerce.

Development gaps might hinder bilateral postal flows through several channels. Differences in quality of service between operators could discourage consumers from ordering from abroad because of lengthy delivery times, which, coupled with predictability issues, discourages them from performing cross-border purchases. Large differences in network size could indicate an inability to order in the first place or difficulties for the operator to offer competitive rates because of the low volumes circulating through its network.

For the purpose of the exercise, the development gap between two countries can be defined as the difference, in absolute value, between their 2IPD scores. International e-commerce flows can be measured as the tonnage of bilateral exports of parcel post. The annual tonnage from 2018 was constructed using EDI messages collected by the UPU's Postal Technology Centre (PTC).

The relationship between the two variables of interest is tested with the help of a gravity

equation.^{xii} Gravity models are a standard instrument in the toolbox of network analysis. They help in modelling bilateral flows as a function of country-specific factors and bilateral cost variables.^{xiii} In the case of the postal network, the gravity model has already been shown to fit the data in a suitable manner.^{xiv} According to the model, bilateral postal flows are inversely proportional to the distance between countries, and directly proportional to the country's economic size.

Bridging the gap

The results from the regression analysis indicate that reducing the difference in 2IPD scores by 1% is correlated with a 0.1% difference in the bilateral tonnage of exported parcel-post items.^{xv} The regression analysis suggests that the area where reducing gaps would yield most gains is reliability: unpredictable and lengthy delivery times are the main discriminants between international and domestic deliveries.^{xvi}

An important question that needs to be answered is whether the agenda for reducing development gaps should be a global or a regional one. There is obviously no clear-cut answer, and there could be several approaches to tackling the question. The gravity model allows for splitting within-region and between-region gains. The main finding is that reducing gaps by 1% between countries in the same region yields lower gains (+0.05%) than between regions (+0.1%).

5. Conclusion

The postal sector is linked to socio-economic development and can play an important role in achieving the UN SDGs. Through the 2IPD, the UPU has a tool to keep track of the evolution of postal development. While some countries continue to over-perform and show encouraging results, the report reveals that development gaps have been widening in recent years.

These development gaps are a threat for the continued development of cross-border e-commerce flows and might hinder consumers, firms and postal operators in unleashing their economic potential. E-commerce remains critical for the future of international postal exchanges; but the promise of growth cannot be fulfilled without a global agenda for the sector.

Indeed, while there are many disparities within regions, a major finding of the report is that most gains would come from bridging the gaps between regions (rather than *within* regions). In other words, countries should pursue *global* rather than *regional* convergence in postal performance.

Multilateral agencies, such as the UPU, have a role to play in supporting this endeavour: thanks to their ability to develop and roll out standards, electronic solutions and capacity building to a wide range of countries, they can become partners in the road to postal development and to the achievement of the UN SDGs.

Appendix 1: Regression analysis

Regression model

The regression model estimates the effect of the development gap on the total bilateral tonnage of parcel post. For two countries i and j , development gaps are defined as:

$$Dev\ Gap_{ij} = \log(|2IPD_i - 2IPD_j|) \quad (1)$$

The standard tool to estimate how costs impede the realization of expected volumes is the gravity equation. In our case, the tonnage of parcel post between two countries, X_{ij} , is modelled through the following relationship:

$$\ln X_{ij} = \alpha + \beta_1 Dev\ Gap_{ij} + \gamma \ln \phi_{ij} + u_i + v_j + \epsilon_{ijt} \quad (2)$$

Where α is a constant, u_i and v_j are country fixed effects that capture all country-specific characteristics, ϵ_{ijt} is a stochastic error term, and ϕ_{ij} is a vector of country pair variables common in gravity analysis (weighted geodesic distance, common official language, common border and common colonizer, all the covariates are taken from the GeoDist database).^{xvii}

In order to test the effect of reducing development gaps within regions, equation (2) is augmented with an interaction coefficient, which takes value 1 if i and j belong to the same region (regional groupings are defined in Table 3):

$$\ln X_{ij} = \alpha + \beta_1 Dev\ Gap_{ij} + \beta_2 Dev\ Gap_{ij} * Same\ Region_{ij} + \gamma \ln \phi_{ij} + u_i + v_j + \epsilon_{ijt} \quad (3)$$

The results are presented in Table 2.

Table 2 Regression analysis

	Dependent variable:	
	Parcel volumes, kg (in logs)	
	(1)	(2)
Bilateral weighted distance (log)	-0.892*** (0.027)	-0.857*** (0.030)
Development gap (log)	-0.087*** (0.019)	-0.094*** (0.019)
Development gap (log) * same region		0.046*** (0.017)
Common colonizer	0.475*** (0.076)	0.457*** (0.077)
Common border	0.079 (0.091)	0.072 (0.091)
Common official language	1.325*** (0.056)	1.302*** (0.056)
Origin country FE	Yes	Yes
Destination country FE	Yes	Yes
Observations	8,595	8,595
R ²	0.729	0.729
Adjusted R ²	0.717	0.718
Residual std. error	1.482 (df = 8251)	1.482 (df = 8250)

Note: Authors' calculations based on the 2019 ZIPD Ranking, CEPII GeoDist database and UPU PREDES EDI messages. *p**p***p<0.01

Table 3 Regional classification of countries and territories

ISO	Country name	Region	ISO	Country name	Region	ISO	Country name	Region
AC	Ascension	IC	GM	Gambia	Africa	NL	Netherlands	IC
AE	United Arab Emirates	Arab countries	GN	Guinea	Africa	NO	Norway	IC
AF	Afghanistan	Asia-Pacific	GQ	Equatorial Guinea	Africa	NP	Nepal	Asia-Pacific
AG	Antigua and Barbuda	Latin America and Caribbean	GR	Greece	IC	NR	Nauru	Asia-Pacific
AI	Anguilla	Latin America and Caribbean	GT	Guatemala	Latin America and Caribbean	NZ	New Zealand	IC
AL	Albania	Europe and CIS	GW	Guinea-Bissau	Africa	OM	Oman	Arab countries
AM	Armenia	Europe and CIS	GY	Guyana	Latin America and Caribbean	PA	Panama (Rep.)	Latin America and Caribbean
AN	Netherlands Antilles	Latin America and Caribbean	HK	Hong Kong, China	Asia-Pacific	PE	Peru	Latin America and Caribbean
AO	Angola	Africa	HN	Honduras (Rep.)	Latin America and Caribbean	PF	French Polynesia	IC
AR	Argentina	Latin America and Caribbean	HR	Croatia	Europe and CIS	PG	Papua New Guinea	Asia-Pacific
AT	Austria	IC	HT	Haiti	Latin America and Caribbean	PH	Philippines	Asia-Pacific
AU	Australia	IC	HU	Hungary	Europe and CIS	PK	Pakistan	Asia-Pacific
AW	Aruba	Latin America and Caribbean	ID	Indonesia	Asia-Pacific	PL	Poland	Europe and CIS
AZ	Azerbaijan	Europe and CIS	IE	Ireland	IC	PN	Pitcairn Islands	IC
BA	Bosnia and Herzegovina	Europe and CIS	IL	Israel	IC	PT	Portugal	IC
BB	Barbados	Latin America and Caribbean	IM	Isle of Man	IC	PY	Paraguay	Latin America and Caribbean
BD	Bangladesh	Asia-Pacific	IN	India	Asia-Pacific	QA	Qatar	Arab countries
BE	Belgium	IC	IQ	Iraq	Arab countries	RO	Romania	Europe and CIS
BF	Burkina Faso	Africa	IR	Iran (Islamic Rep.)	Asia-Pacific	RS	Serbia	Europe and CIS
BG	Bulgaria (Rep.)	Europe and CIS	IS	Iceland	IC	RU	Russian Federation	Europe and CIS
BH	Bahrain (Kingdom)	Arab countries	IT	Italy	IC	RW	Rwanda (Rép.)	Africa
BI	Burundi	Africa	JE	Jersey	IC	SA	Saudi Arabia	Arab countries
BJ	Benin	Africa	JM	Jamaica	Latin America and Caribbean	SB	Solomon Islands	Asia-Pacific
BM	Bermuda	Latin America and Caribbean	JO	Jordan	Arab countries	SC	Seychelles	Africa
BN	Brunei Darussalam	Asia-Pacific	JP	Japan	IC	SD	Sudan	Arab countries
BO	Bolivia	Latin America and Caribbean	KE	Kenya	Africa	SE	Sweden	IC
BR	Brazil	Latin America and Caribbean	KG	Kyrgyzstan	Europe and CIS	SG	Singapore	Asia-Pacific
BS	Bahamas	Latin America and Caribbean	KH	Cambodia	Asia-Pacific	SH	St. Helena	Latin America and Caribbean
BT	Bhutan	Asia-Pacific	KI	Kiribati	Asia-Pacific	SI	Tristan da Cunha	IC
BW	Botswana	Africa	KM	Comoros	Arab countries	SK	Slovakia	Europe and CIS
BY	Belarus	Europe and CIS	KN	Saint Christopher (St. Kitts) and Nevis	Latin America and Caribbean	SL	Sierra Leone	Africa
BZ	Belize	Latin America and Caribbean	KP	Dem People's Rep. of Korea	Asia-Pacific	SM	San Marino	IC
CA	Canada	IC	KR	Korea (Rep.)	Asia-Pacific	SN	Senegal	Africa
CD	Democratic Republic of the Congo	Africa	KW	Kuwait	Arab countries	SO	Somalia	Arab countries
CF	Central African Rep.	Africa	KY	Cayman Islands	Latin America and Caribbean	SR	Suriname	Latin America and Caribbean
CG	Congo (Rep.)	Africa	KZ	Kazakhstan	Europe and CIS	SS	South Sudan	Arab countries
CH	Switzerland	IC	LA	Lao People's Dem. Rep.	Asia-Pacific	ST	Sao Tome and Principe	Africa
CI	Côte d'Ivoire (Rep.)	Africa	LB	Lebanon	Arab countries	SV	El Salvador	Latin America and Caribbean
CL	Chile	Latin America and Caribbean	LC	Saint Lucia	Latin America and Caribbean	SY	Syrian Arab Rep.	Arab countries
CM	Cameroon	Africa	LI	Licchtenstein	IC	SZ	Eswatini	Africa
CN	China (People's Rep.)	Asia-Pacific	LK	Sri Lanka	Asia-Pacific	TC	Turks and Caicos Islands	Latin America and Caribbean
CO	Colombia	Latin America and Caribbean	LR	Liberia	Africa	TD	Chad	Africa
CR	Costa Rica	Latin America and Caribbean	LS	Lesotho	Africa	TG	Togo	Africa
CU	Cuba	Latin America and Caribbean	LT	Lithuania	Europe and CIS	TH	Thailand	Asia-Pacific
CV	Cape Verde	Africa	LU	Luxembourg	IC	TJ	Tajikistan	Europe and CIS
CY	Cyprus	Europe and CIS	LV	Latvia	Europe and CIS	TL	Timor-Leste (Dem. Rep.)	Asia-Pacific
CZ	Czech Rep.	Europe and CIS	LY	State of Libya	Arab countries	TM	Turkmenistan	Europe and CIS
DE	Germany	IC	MA	Morocco	Arab countries	TN	Tunisia	Arab countries
DJ	Djibouti	Arab countries	MC	Monaco	IC	TO	Tonga	Asia-Pacific
DK	Denmark	IC	MD	Moldova	Europe and CIS	TR	Turkey	Europe and CIS
DM	Dominica	Latin America and Caribbean	ME	Montenegro	Europe and CIS	TT	Trinidad and Tobago	Latin America and Caribbean
DO	Dominican Republic	Latin America and Caribbean	MG	Madagascar	Africa	TV	Tuvalu	Asia-Pacific
DZ	Algeria	Arab countries	MK	North Macedonia	Europe and CIS	TZ	Tanzania (United Rep.)	Africa
EC	Ecuador	Latin America and Caribbean	ML	Mali	Africa	UA	Ukraine	Europe and CIS
EE	Estonia	Europe and CIS	MM	Myanmar	Asia-Pacific	UG	Uganda	Africa
EG	Egypt	Arab countries	MN	Mongolia	Asia-Pacific	US	United States of America	IC
ER	Eritrea	Africa	MO	Macao, China	Asia-Pacific	UY	Uruguay	Latin America and Caribbean
ES	Spain	IC	MR	Mauritania	Arab countries	UZ	Uzbekistan	Europe and CIS
ET	Ethiopia	Africa	MS	Montserrat	Latin America and Caribbean	VA	Vatican	IC
FI	Finland	IC	MT	Malta	Europe and CIS	VC	Saint Vincent and the Grenadines	Latin America and Caribbean
FJ	Fiji	Asia-Pacific	MU	Mauritius	Africa	VE	Venezuela (Bolivarian Rep.)	Latin America and Caribbean
FK	Falkland Islands (Malvinas)	IC	MV	Maldives	Asia-Pacific	VG	Virgin Islands	Latin America and Caribbean
FO	Faroe Islands	IC	MW	Malawi	Africa	VN	Viet Nam	Asia-Pacific
FR	France	IC	MX	Mexico	Latin America and Caribbean	VU	Vanuatu	Asia-Pacific
GA	Gabon	Africa	MY	Malaysia	Asia-Pacific	WF	Wallis and Futuna Islands	IC
GB	United Kingdom	IC	MZ	Mozambique	Africa	WS	Samoa	Asia-Pacific
GD	Grenada	Latin America and Caribbean	NA	Namibia	Africa	YE	Yemen	Arab countries
GE	Georgia	Europe and CIS	NC	New Caledonia	IC	ZA	South Africa	Africa
GG	Guernsey	IC	NE	Niger	Africa	ZM	Zambia	Africa
GH	Ghana	Africa	NF	Norfolk Island	IC	ZW	Zimbabwe	Africa
GI	Gibraltar	IC	NG	Nigeria	Africa			
GL	Greenland	IC	NI	Nicaragua	Latin America and Caribbean			

Appendix 2: Methodology for calculating the 2IPD index

1. General concept and notation

The 2IPD measures the comparative performance of countries in terms of postal development. As a composite index, the individual final scores are based on several components, called sub-variables. These sub-variables are (conceptually) grouped into four pillars: reach, reliability, relevance and resilience. Sub-scores are computed for each of these pillars and then consolidated into the final score, which takes a value between 0 and 100.

The scores are constructed sequentially and hierarchically in the following manner:

- A sub-variable is rescaled between 0 and 100, i.e. the minimum (or the maximum) value;
- The rescaled sub-variables are weighted and added together in a given sequence;
- The above-mentioned sum is rescaled again between 0 and 100.

In the description of the 2IPD methodology presented henceforth, a vector notation will be used, with vectors and matrices expressed in bold print. Let \mathbf{a}_i be the value of a sub-variable a for the country i . In order to denote a collection of values of a for countries $i = 1 \dots k$ the individual values \mathbf{a}_i are grouped into a vector: $\mathbf{a} = (\mathbf{a}_1, \dots, \mathbf{a}_k)^T$.

The rescaling of the vector \mathbf{a} is done by multiplying it by a diagonal matrix \mathbf{S} with typical elements defined as:

$$\begin{aligned} \mathbf{S}[i, i] &= 100 \frac{\min_k \mathbf{a} - \mathbf{a}[i]}{\min_k \mathbf{a} - \max_k \mathbf{a}}, \\ \mathbf{S}[i, j] &= 0 \text{ for } i \neq j \end{aligned} \quad (1.1)$$

Thus, the vector \mathbf{Sa} contains the scores for the sub-variable normalized between 0 and 100.

2. Reach score

2.1 Reach: concept and data sources

The reach score is based on the degree of (international) connectivity of the postal network. The connectivity is measured by the number of outbound partners and the number of outbound items for each mail segment (letters, parcels and express). The higher the number of partners and the volume expressed in items, the higher the reach score.

The data needed to compute the reach scores are contained in the pre-advice of dispatch (PREDES) EDI messages gathered by the UPU.

2.2 Notation

The notation is as follows:

K	is the number of countries for which scores are computed
A	is the set of sending (origin) countries.
B	is the set of destination countries
$A \times B$	is the set of all possible country-to-country flows
$O_i D$	is the multiset of all country-to-country registrations for the origin country i in the PREDES file. Each country-to-country flow in this multiset belongs to $A \times B$ but same flows may appear many times (it may occur that $ O_i D > A \times B $).
n_{ijdc}	is the number of items dispatched from country i to country j on date d for mail class c ($c \in \{\text{"letters"}, \text{"parcels"}, \text{"express"}\}$).

2.3 Sub-variables

Two sub-variables take part in the calculation of the reach score. First, the number of partners is the number of distinct (unique) destination partners for the given origin country i (the cardinal number of the support of the multiset $O_i D$), which is defined as:

$$rpartners_i = |\text{supp } O_i D|, \quad (2.1)$$

Second, the total number of items, in logarithmic scale, dispatched from country i regardless of mail class.

$$rvolume_i =: \ln(\sum_c \sum_d \sum_j n_{ijdc}) \quad (2.2)$$

2.4 Calculation of reach score

The last step consists in applying transformation (1.1) to the two sub-variables and standardizing the average between the two between 0 and 100. In vector notation this leads to:

$$\mathbf{reach} = : S(\mathbf{S}rpartner + \mathbf{S}rvolume) \quad (2.4)$$

The components of the vector **reach** are the individual reach scores corresponding to each country.

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3. Reliability score

3.1 Reliability: concept and data sources

The reliability score is based on the performance of a given country in terms of speed and predictability of delivery of incoming items, as measured by the tracking events recorded in EMS item events (EMSEVT) EDI messages, collected by the UPU through the PTC. The underlying assumption for measuring quality of service this way is that performance should not be assessed according to delivery standards, which are more arbitrary and may vary considerably from one country to another. Instead, the assumption is that high performing Posts are those that can deliver mail within an acceptable average time, with a reasonable amount of variability from this average. The total score of the pillar is based on two main sub-variables, speed of delivery and predictability of delivery.

3.2 Notation

The following notation applies:

T_{cij} is the time elapsed between scanning of the event HI and event D, in country i , for item j belonging to the category of mail c ($c \in \{\text{"letters"}, \text{"parcels"}, \text{"express"}\}$)

avT_{ci} is the average time T_{ci} for mail class c and country i . In other terms:

$$avT_{ci} = \frac{1}{N_{ci}} \sum_{j=1}^{N_{ci}} T_{cij}, \quad (3.1)$$

where N_{ci} is the number of valid observations (scanned items) for mail category c in country i

sdT_{ci} is the standard deviation of observations T_{cij} from mean avT_{ci} .

$$sdT_{ci} = \sqrt{\frac{\sum_{j=1}^{N_{ci}} (T_{cij} - avT_{ci})^2}{N_{ci} - 1}}, \quad (3.2)$$

where N_{ci} is the number of valid observations (scanned items) for mail category c in country i .

3.3 Sub-variables

There are two main sub-variables that have to be computed. First, the speed of delivery, defined as:

$$rspeed_i = \frac{1}{N_i} \sum_{c=1}^{N_i} avT_{ci}, \quad (3.3)$$

The speed of delivery, $rspeed_i$, is the average across mail classes of avT_{ci} for country i . N_i represents the number of different mail classes (letters, parcels, express) in country i .

The second sub-variable is the predictability of delivery, defined as:

$$rpredi_i = \frac{1}{N_i} \sum_{c=1}^{N_i} sdT_{ci} \quad (3.4)$$

Once again, this is the simple average of sdT_{ci} over valid mail classes for country i . Here too, N_i is the number of valid avT_{ci} times for the country i .

3.3 Calculation of reliability scores

The last step for the reliability pillar consists in applying transformation (1.1) to the two sub-variables and standardizing the average between the two between 0 and 100.

Notice that in the case of both $rspeed_i$ and $rpredi_i$, the lower the value, the better the performance. Therefore the standardization needed, using the vector notation, is:

$$Srspeed = S(-rspeed) \quad (3.5)$$

$$Srpredi = S(-rpredi) \quad (3.6)$$

The final reliability scores are obtained by rescaling the sum between the two:

$$reliability = : S(Srspeed + Srpredi) \quad (3.7)$$

This leads to the final reliability scores.¹

¹ These final scores are compared with reach scores in order to control for countries with very few observations.

4 Relevance score

4.1 Relevance: concept and data sources

The relevance score measures the degree of competitiveness of a given operator in its most important business segment (letters, parcels, financial services) as well as the density of its infrastructure. To this end, the most important business segment is first identified, then compared with the best performing operator for this segment in the world. The (rescaled) distance from the best performing operator becomes the first sub-variable. The second sub-variable is the rescaled number of permanent postal offices per capita. Contrary to what is done for the previous pillars, the sub-scores of relevance do not receive the same weight in the final calculation. The data needed to compute the relevance score is derived from the official UPU Postal Statistics and UN statistics (for population data).

4.2 Notation

The following notation is used:

k	is the number of countries for which scores are computed for the given year
$vpal_i$	is the percentage of revenue generated by the letter post for the given country i . If not available for the given year, the latest value from the last five years is taken.
$vcoll_i$	is the percentage of revenue generated by parcel post and logistics. If not available for the given year, the latest value from the last five years is taken.
$vsfp_i$	is the percentage of revenue generated by the financial postal services. If not available for the given year, the latest value from the last five years is taken.
$palint_i$	is the number of domestic letter-post items in country i .

- $palexp_i$ is the number of international exported letter-post items in country i .
- $popul_i$ is the population of country i .
- $bseden_i$ is the value of permanent post offices (including outsourced ones) in country i .

4.3 Sub-variables

Before identifying the most important transaction segment it is necessary to define a certain number of variables.

- $tpal_i$ is the number of letter post transactions per capita in country i

$$tpal_i =: \frac{palint_i + palexp_i}{popul_i}, \quad (4.1)$$

- $tcol_i$ is the number of postal transactions attributed to parcel post, but expressed in “letter post units”

$$tcol_i =: \begin{cases} \frac{vcol_i}{vpal_i} tpal_i, & vpal_i \neq 0 \text{ and available} \\ 0, & \text{otherwise} \end{cases} \quad (4.2)$$

- $tsfp_i$ is the number of postal transactions attributed to postal financial services, expressed in “letter post units”.

$$tsfp_i =: \begin{cases} \frac{vsfp_i}{vpal_i} tpal_i, & vpal_i \neq 0 \\ 0 & \text{otherwise} \end{cases} \quad (4.3)$$

- $infra_i$ is the number of permanent post offices per capita in country i .

$$infra_i =: \frac{bseden_i}{popul_i}, \quad (4.4)$$

4.4 Identification of top-performing segments

The observations $tpal_i, tcol_i, tsfp_i, infra_i$ are stacked up for all countries into vectors $tpal, tcol, tsfp, infra$, which in turn are rescaled according to (1.1). This yields four vectors: $Stpal, Stcol, Stsfp, Sinfra$. At this point it is necessary to identify, for each country, its most important segment, $Strans_i$, which is defined as:

$$Strans_i =: \max\{Stpal_i, Stcol_i, Stsfp_i\} \quad (4.5)$$

4.5 Calculation of relevance scores

The relevance scores are the following linear combination of ***Strans*** and ***Sinfra***:

$$relevance =: S(0.75 * Strans + 0.25 * Sinfra). \quad (4.6)$$

5 Resilience scores

5.1 General concept and data source

The resilience score relies on a number of factors, which determine a postal operator's adaptability to economic, social, technological and environmental shocks.

Firstly, a combination of factors such as the mail volumes decline rate, the level of economies of scale achieved by the postal mail delivery network or the degree of diversification in terms of postal revenues measures the level of economic strength of a given postal business model in response to both macroeconomic and technological shocks.

Secondly, the potential for delivering financial inclusion through the postal network constitutes a measure of the level of social resilience provided by postal operators in order to mitigate economic and social inequalities within any given country.

The data needed to compute the resilience score is sourced from the official UPU Postal Statistics, as well as the UPU's Global Panorama on Financial Inclusion.

In most cases, the key variables are transformed into scores which are functions of critical value thresholds.

5.2 Notation

Let us denote by:

k	is the number of countries for which scores are computed for the given year.
vpa_i	is the proportion of revenue generated by letter post for the given country i .
$vcol_i$	is the proportion of revenue generated by parcel post and logistics.
$vsfp_i$	is the percentage of revenue generated by financial postal services.
$vaut_i$	is the percentage of revenue generated by other services.
$palint_i$	is the number of domestic letter-post items in country i for the given year

$palexp_i$ is the number of international exported letter-post items in country i for the given year

$palint_prev_i$ is the number of domestic letter-post items in country i three years ago

$palexp_prev_i$ is the number of international exported letter-post items in country i three years ago

$popul_i$ is the population of country i for the given year

5.3 Computation of sub-variables

$vdec_i$ is the ratio of decline of letter-post volumes

$$vdec_i = \frac{palint_i + palexp_i}{palint_prev_i + palexp_prev_i}, \quad (5.1)$$

$veco_i$ is the number of letter-post items per capita

$$veco_i = \frac{palint_i + palexp_i}{popul_i} \quad (5.2)$$

$sdec_i$ is the indicator of letter post decline in country i

$$sdec_i = \frac{1}{1 + e^{-10(vdec_i - 0.9)}}, \quad (5.3)$$

This function takes values between 0 and 1. If the ratio of decline of letter post is below the threshold of 0.9 the function rapidly tends to zero. Conversely, above the threshold it rapidly tends to 1.

$seco_i$ is the indicator of economies of scale for country i (threshold = 15).

$$seco_i = \frac{1}{1 + e^{-(veco_i - 15)}}, \quad (5.4)$$

$seor_i$ is the indicator of concentration on other services than postal business

$$seor_i = \frac{1}{1 + e^{(vaut_i - 33.3)}} \quad (5.5)$$

Above the threshold of 33.3% the function tends rapidly to 0, below the threshold to 1.

$scon_i$ is the indicator of diversification of services in country i

$$scon_i = \sqrt{(1 - vpa_i)(1 - vcol_i)(1 - vsfp_i)}, \quad (5.6)$$

The variables $vpa_i, vcol_i, vsfp_i$ are the relevant proportions of

revenue generated by the given service, and here they are represented by values between 0 and 1 and not, as in postal statistics, in percentages. The higher the diversification, the greater the function value. If the arguments are missing the function will get the value of 0.

$fincl_i$ is the individual score of country i in Postal Financial Potential Success Index as found in the UPU's Global Panorama for Financial Inclusion.

5.4 Calculation of resilience scores

First, we compute the variable of economic resilience. To this end, for each country i we sum together the four variables computed according to (5.3), (5.4), (5.5), (5.6):

$$ecores_i = sdec_i + seco_i + scon_i + seor_i, \quad (5.7)$$

Then, the variables $ecores_i$ and $fincl_i$ are assembled into vectors ***ecores***, ***fincl***, which in turn are rescaled according to (1.1). This yields two vectors, ***Secores***, ***Sfincl***.

The final resilience scores are computed according to the usual formula:

$$resilience = : S(Scores + Sfincl). \quad (5.8)$$

6. The 2IPD scores

Once all the scores for the four pillars have been computed, the final 2IPD scores can be obtained. For each country, the sum of the four scores is taken and then rescaled according to (1.1).

$$2IPD = : S(reach + reliability + relevance + resilience). \quad (6.1)$$

Endnotes

ⁱ Rogowski, J.C., Gerring, J., Cojocaru, L. and Maguire, M. (2017). Communications Infrastructure and Economic Development: Evidence from Postal Systems.

ⁱⁱ UPU (2019). Postal Economic Outlook.

ⁱⁱⁱ The 2016 Istanbul Congress gave the International Bureau a mandate to update and release the 2IPD results on a regular basis for the purposes of maintaining indicators for cooperation and development purposes.

^{iv} The discussion revolves around the quintiles of the 2IPD statistical distribution.

^v Regional categories defined in the appendix.

^{vi} UPU (2019). Postal Economic Outlook.

^{vii} World Bank (2019). Global Economic Prospects, June 2019, Washington, DC

^{viii} Productivity is measured by GDP per person employed. The correlation coefficient between the two is 61%.

^{ix} The correlation coefficient between the two is 68%.

^x UPU (2019). Postal Economic Outlook.

^{xi} Ibid. As of 2017, domestic letter-post volumes were 309.9 billion items, while international letter-post items totalled 3.60 billion.

^{xii} Head, K., & Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In *Handbook of international economics* (Vol. 4, pp. 131-195). Elsevier.

^{xiii} The control variables included in the model are standard from gravity studies, namely : bilateral distance, common colonizer, contiguity and common official language. The regression tables are reported in Appendix 1.

^{xiv} Ansón, J., & Helble, M. (2013). A gravity model of international postal exchanges. *Reforming the postal sector in the face of electronic competition*, pp 36-47.

^{xv} Details on the value of the coefficients can be found in Appendix 1.

^{xvi} The message is consistent with the findings in Ansón, J., Arvis, J. F., Boffa, M., Helble, M., & Shepherd, B. (2017). *Time, uncertainty, and trade flows* (No. 673). ADBI Working Paper Series.

^{xvii} Mayer, T. & Zignago, S. (2011). Notes on CEPII's distance measures: the GeoDist Database CEPII Working Paper 2011-25.

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