In public discourse, pundits often use terms such as *developed* or *emerging* when referring to countries worldwide. Regardless of whether these labels are meaningful and accurate, the fact remains that they are widely used in public discourse and sometimes in academia too. We can think of them as an attempt to categorise countries based on their level of development. In other words, assigning labels such as *developed* or *emerging* is an instance of using a categorical measure to describe countries' level of development. A particular example of this categorisation can be found in the World Economic Situation and Prospects Report (WESP) issued by the UN (UN DESA 2022).

In WESP, countries are classified as *developed, in transition* or *developing*. These categories are mutually exclusive and collectively exhaustive. They *"are intended to reflect basic economic country conditions"* (UN DESA 2022, p. 151). Hence, the concept of interest WESP tries to capture by this categorisation is the basic economic condition of a country. Furthermore, WESP authors want this measure to be categorical for practical purposes.

Unfortunately, it is unclear what indicators the authors use to categorise the countries into the three categories and how they aggregate them. Nevertheless, it is relatively easy to suggest several indicators we would expect to be correlated with the concept of interest. In particular, I would expect cross-country variation in indicators such as HDI, GNI per capita and GDP per capita to be partially explainable by the country's basic economic condition.

To investigate whether this is the case, I estimated three regression models with the WESP category as the independent variable and GDP per capita PPP, GDP per capita PPP and HDI as the dependent variables (Table 1). The R-squared suggests that WESP categories explain more than 40% of the variation in all three dependent variables. That is relatively high predictive power for a single categorical variable with just three classes. The coefficients suggest that developed countries have the highest value of all three indicators on average, whereas developing countries have the lowest. Countries in transition fall between them, although the difference between countries in transition and developing countries is substantively small.

Table 1: Summary of linear regression models with WESP categories as the independent variable and different economic measures as dependent variables. Coefficients and standard errors (in brackets) are reported.

	GNI per capita PPP	**GDP per capita PPP**	**HDI**
Predictors	*Estimates*	*Estimates*	*Estimates*
Intercept	45,963*** (2,538)	52,784*** (3,152)	0.908*** (0.019)
WESP category (reference: developed)			
developing	-32,791*** (2,945)	-37,676*** (3,657)	-0.253*** (0.023)
transition	-30,936*** (4,482)	-35,659*** (5,565)	-0.136*** (0.034)
Observations	157	157	157
R^2	0.452	0.414	0.457
Adjusted R^2	0.444	0.406	0.450

$^{*}p<0.05$ $^{**}p<0.01$ $^{***}p<0.001$

Despite the relatively high explanatory power of WESP's country classification, it has some considerable downsides. Most importantly, the categorisation methodology is unclear. A WESP reader does not know which indicators were used to create the categorical measure and how they were aggregated. This lack of clarity makes it difficult to explain why a particular country was assigned to one category and not the other. A second problem, which is a consequence of the first, is that some

countries are classified in a controversial way. For instance, South Korea is classified as a country in transition, even though it is a democracy with a similar level of HDI as developed countries. On the other hand, Bulgaria, with a much lower HDI, is classified as a developed country. It is unclear what drives assignment in these two cases due to the lack of clarity in the measurement methodology. Finally, around three-quarters of countries are classified as developing, and only a handful are classified as economies in transition. Countries such as UAE and Burundi, with massive differences in living standards, are in the same category. Although this is, to some degree, unavoidable if we want to construct a categorical measure, it seems that including more countries in the *in transition* category would reflect the cross-country differences in development better.

As an alternative to the WESP categorisation, I propose a classification based on three indicators and a gaussian mixture model. The concept of interest is the basic economic condition of a country. We can disaggregate it into past, present and future economic conditions, which allows us to capture both the static and the dynamic aspects of economic development. The three indicators I used to create the measure are intended to reflect these three aspects of our concept of interest. They are the compound annual growth rate of GDP at PPP per capita from the last 25 years (or slightly less, depending on data availability), the most recent HDI value and the most recent Democracy Index value.

I would like to make two remarks about this methodology. Firstly, there is undoubtedly some overlap between the indicators. Past, present and future economic conditions are interdependent. Furthermore, the HDI index includes education and life expectancy, which also influence the future performance of a country's economy. Nevertheless, the correlation between the three coefficients is not very high, suggesting they measure slightly different concepts (Table 2). Secondly, the use of the Democracy Index as an indicator of the future economic performance of a country is informed by research within development economics, which shows that economic institutions are by far the most relevant factor in a country's future development (Acemoglu et al. 2001, 2002, 2005).

Table 2: Pearson correlation coefficients for indicators used to construct the measure.

	HDI	Democracy Index	Economic Growth
HDI	-		
Democracy Index	0.66	-	
Economic Growth	0.15	0.07	-

I use these three indicators to estimate a gaussian mixture model classifying countries into three groups and compare them with WESP's classification. The first group (green) is characterised by a high value of the HDI and the Democracy Index and a moderate level of economic growth (see Figure 1). Countries in the second group (red) have, on average, a lower value of the HDI and the Democracy Index but higher economic growth. The third class (blue) is characterised by a relatively low value of the HDI and the Democracy Index and a moderate economic growth level.

To compare my classification with the WESP categories, I look at the mean and the standard deviation of the three indicators within each class (Table 3). I would like to point out three differences between the two classifications. Firstly, there is less variation in the group size in my categorisation compared to the one found in WESP. A second difference is that in my classification, the groups differ more on average with respect to the HDI and the Democracy Index and less by economic growth as measured by range. Thirdly, the developed group in my classification includes fewer countries, and there is less within-group variation in all three indicators in that group under my classification.

Figure 1: Correlation plot between the three indicators with class assignment.

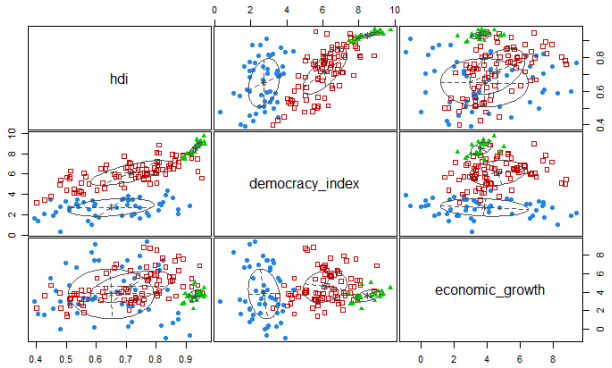

Table 3: Comparison between WESP and my categories. Means and standard deviations (in brackets) are reported.

Category	WESP categorisation				My categorisation			
	Count	HDI	Democracy Index	Economic Growth	Count	HDI	Democracy Index	Economic Growth
Green/ Developed	36	0.91 (0.04)	8.03 (0.92)	4.53 (1.50)	23	0.93 (0.02)	8.51 (0.66)	3.61 (0.64)
Red/ Transition	17	0.77 (0.04)	4.27 (1.72)	6.78 (1.17)	84	0.71 (0.14)	6.10 (1.20)	4.57 (1.69)
Blue/ Developing	134	0.66 (0.13)	4.52 (1.96)	3.56 (1.90)	50	0.65 (0.14)	2.68 (0.82)	3.85 (2.72)

All countries belonging to a different category under my classification are listed in Table 4. One advantage of my classification method over WESP's is that the indicators used to create the measure are clearly defined, and the aggregation methodology is transparent. Furthermore, the definition of the categories is now easier to pin down. The *In transition* class includes countries with a moderate value of the HDI and the Democracy Index and a high level of economic growth. The *Developed* category includes very similar countries (as indicated by low standard deviations) with a high value of the HDI and the Democracy Index and a moderate level of economic growth. Finally, the *developing* class contains countries with a low value of the HDI and the Democracy Index and a moderate economic growth level on average but with a lot of variation. Together, these advantages allow us to explain more precisely why a country was assigned to a particular category. For instance, South Korea is classified as a developed economy due to its high value of the HDI and the Democracy Index. Although its economic growth equals 4.78, which is much higher than the average for developed countries, it remains small enough for South Korea to belong to the developed category.

However, my method is not without its downsides. Firstly, since gaussian mixture models belong to the unsupervised category of measurement strategies, we cannot be sure that our measurement captures our concept of interest. The algorithm's aim is to find the classification that explains as much variation in the data as possible, which may not be associated with our concept of interest. Secondly, some assignments seem dubious at best. For instance, Ireland and Belgium are classified as countries in transition. This is due to Ireland's remarkably high level of economic growth, and Belgium's relatively poor score on the Democracy Index. Hence, the proposed measure should go through another round of classification where an analyst would go through the country assignments and re-assign countries if there are good reasons to do so since a simple unsupervised strategy cannot capture all the relevant factors. Furthermore, the model could be trained again using a different set of indicators measuring the same target concepts (eg. using the Polity IV score instead of the Democracy Index) to increase the robustness of the classification.

The WESP country classification is a good categorical measure as it explains a lot of variation in variables related to the target concept. However, its construction is unclear, which can be mitigated by employing an unsupervised measurement strategy with indicators chosen to reflect the target concept based on academic literature. However, this strategy would need to be reviewed by an analyst as it does not capture all the relevant factors, which results in some dubious country assignments.

Table 4: Countries assigned under different group under my categorisation and compared to WESP categorisation.

Country	WESP group	My group
Argentina	developing	transition
Azerbaijan	transition	developing
Bangladesh	developing	transition
Belarus	transition	developing
Belgium	**developed**	**transition**
Benin	developing	transition
Bhutan	developing	transition
Bolivia	developing	transition
Botswana	developing	transition
Brazil	developing	transition
Bulgaria	developed	transition
Burkina Faso	developing	transition
Chile	developing	transition
Colombia	developing	transition
Costa Rica	developing	transition
Croatia	developed	transition
Czechia	developed	transition
Dominic. Rep.	developing	transition
Ecuador	developing	transition
El Salvador	developing	transition
Estonia	developed	transition
Fiji	developing	transition
Gambia	developing	transition
Ghana	developing	transition
Guatemala	developing	transition
Guyana	developing	transition
Honduras	developing	transition
Hong Kong	developing	transition
Hungary	developed	transition
India	developing	transition
Indonesia	developing	transition
Ireland	**developed**	**transition**
Israel	developing	developed
Ivory Coast	developing	transition
Jamaica	developing	transition
Kazakhstan	transition	developing
Kenya	developing	transition
Kyrgyzstan	transition	developing
Latvia	developed	transition
Lesotho	developing	transition
Liberia	developing	transition
Lithuania	developed	transition
Madagascar	developing	transition

Country	WESP group	My group
Malawi	developing	transition
Malaysia	developing	transition
Mali	developing	transition
Malta	developed	transition
Mauritania	developing	transition
Mauritius	developing	transition
Mexico	developing	transition
Mongolia	developing	transition
Morocco	developing	transition
Namibia	developing	transition
Nepal	developing	transition
Niger	developing	transition
Nigeria	developing	transition
Pakistan	developing	transition
Panama	developing	transition
Papua New Guinea	developing	transition
Paraguay	developing	transition
Peru	developing	transition
Philippines	developing	transition
Poland	developed	transition
Portugal	developed	transition
Romania	developed	transition
Russia	transition	developing
Senegal	developing	transition
Sierra Leone	developing	transition
Singapore	developing	transition
Slovakia	developed	transition
Slovenia	developed	transition
South Africa	developing	transition
South Korea	**developing**	**developed**
Sri Lanka	developing	transition
Suriname	developing	transition
Tajikistan	transition	developing
Tanzania	developing	transition
Thailand	developing	transition
Trinidad and Tobago	developing	transition
Tunisia	developing	transition
Turkmenistan	transition	developing
Uganda	developing	transition
Uruguay	developing	transition
Uzbekistan	transition	developing
Zambia	developing	transition

References

1. Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). *The colonial origins of comparative development: An empirical investigation*. American economic review, 91(5), 1369-1401.
2. Acemoglu, D., Johnson, S., & Robinson, J. A. (2002). *Reversal of fortune: Geography and institutions in the making of the modern world income distribution*. The Quarterly journal of economics, 117(4), 1231-1294.
3. Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). *Institutions as a fundamental cause of long-run growth*. Handbook of economic growth, 1, 385-472.
4. United Nations Department of Economic and Social Affairs (UN DESA) (2022). *World Economic Situation and Prospects 2022.*