Precise steps of the employment projection methodology

I) Getting a projected distribution of sectoral value added

A. Creating a first projection using historical data

1- Obtain historical data from the UN and ILOSTAT for GDP, composition of demand, sectoral value added, labour force, employment, unemployment, labour market institutions.

2- Create groups of countries according to the similarity of their macroeconomic structures and their past trends.

3- Find which econometric model fits best historical changes in the distribution of demand. Arellano-Bond dynamic panel data and time series models using especially GDP growth, total population changes, labour force participation rate changes as explanatory variables and with country fixed effects or regional clustering should be tested.

4- Use these historical trends to compute a future trend up to 2030.

5- Test the same panel data and time series technics using the historical changes in the composition of aggregate demand and other explanatory variables to find which econometric model fits best the historical sectoral value added.

6- Use the best model with the projected values of aggregate demand and other explanatory variable to compute a future trend up to 2030 for the sectoral value added.

7- Normalize the composition of demand and the sectoral value added by transforming them in shares. Check and modify if needed the rounding up to make sure the total is 100%.

B. Taking into account projected exogenous factors to improve our trends

8- Create an "exogenous factors matrix" that shows consequences of exogenous factors not present in the historical trends. Use knowledge of topic and country experts to build it. It has to be separated between factors influencing the sectoral value added and those influencing the employment inside the sector but not the value added. We assume that the former factors influence identically each occupation within a sector while the latter has different employment consequences for each occupation within a sector. Also, consider that factors may play a role beyond the borders or that the same factor may occur in a similar, geographically close country (which may help filling the matrix for countries for which information is scarce).

9- Modify the trend according to the sectoral value added part of the "exogenous factors matrix". As it adds or subtract shares to different sectors, use a simple cross-product to make the total equal to 100% again.

C. Using the projection of Oxford Economics to improve our trends

10- Obtain the projected composition of aggregate demand and of sectoral value added from Oxford Economics for the countries it exists.

11- Compare the historical part of the Oxford Economic trend with the data from the UN. If differences are present, modify the Oxford Economics trend. Then, change the level (but not the slope) of the projected trend accordingly.

12- Transform the Oxford Economics data into shares to have normalized data (and check that the total equals 100%).

13- Compare our trends to the ones of Oxford Economics:

- Use the Oxford Economics trends if they are very close to ours as their model is more complex and therefore supposedly more precise;

- Use a mix of both trends if it looks like the Oxford Economics did not include some exogenous factors we believe are crucial;

- Otherwise, use our judgement to see which trend makes more sense.

14- For countries for which the Oxford Economics projection does not exist, compare their trends with that of countries with similar trends and with an Oxford Economics projection (removing exogenous factors) and use our judgement to make changes.

15- Look at the projection for all countries to change any illogical trend. Check each step since the beginning for a specific country if its trend does not make sense. At the end we get are final sectoral value added projection.

II) Getting the projection of employment by sector and occupation

A. Making a first projection of employment by sector

16- Test Arellano-Bond dynamic panel data and time series models with country and sectoral fixed effects or regional clustering on historical data to find the econometric model that best predict employment changes by sector given changes in sectoral value added.

17- Use this historical model to compute future sectoral employment trends up to 2030.

18- Modify the trend according to the exogenous factors influencing sectoral employment. Use a simple cross-product to make the total equal to 100%.

B. Getting the EPMs

19- Obtain the data of Employment Projection Models (EPMs) for all the countries it exists.

20- Transform their sectors and occupations to the international classifications at the first digit to get a coherent database.

21- Normalize the data by transforming them into shares (and check that the total equals 100%).

22- Add the exogenous factors modifying sectoral value added and then those modifying sectoral employment and that were not foreseeable at the time the model was built. Use a simple cross-product to make the total equal to 100%.

C. Using the EPMs to improve the projection

23- For countries with an EPM, modify the slope of our sectoral employment projection so that it goes through the points projected by the EPM.

24- Use those EPMs to also modify the slope of the sectoral employment projection for similar countries (removing the exogenous factors influencing both sectoral value added and sectoral employment).

25- Look at the projection for all countries to change any illogical trend. Check manually every step since step 16 for the specific countries that have a trend that does not make sense. A final sectoral employment projection is obtained.

D. Making a first projection of employment by occupation

26- Test Arellano-Bond dynamic panel data and time series models with country and occupational fixed effects or regional clustering on historical data to find the econometric model that best predict occupational employment changes given changes in sectoral employment.

27- Use this historical model to compute future occupational employment.

28- Modify the trend according to the exogenous factors modifying occupational employment. Use a simple cross-product to make the total equal to 100%.

E. Using EPMs to improve the projection

29- For the occupational employment projection trends in the EPMs, add the exogenous factors modifying occupational employment and that were not foreseeable at the time the model was built. Use a simple cross-product to make the total equal to 100%.

30- For countries with an EPM, modify the slope of our occupational employment projection so that it goes through the points projected by the EPM.

31- Use those EPMs to also modify the slope of the occupational employment projection for similar countries (removing the exogenous factors influencing sectoral value added and occupational and sectoral employment).

32- Look at the projection for similar countries to change any illogical trend. Check manually every step since step 27 for the specific countries that have a trend that does not make sense. A final occupational employment projection is obtained.