

Giant oil and gas field discoveries 1868-2018

An extended version of Horn's giant oil and gas field discoveries dataset for economic analysis

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Codebook

SCOPE

Years included: the dataset contains giant fields that were discovered between 1868 and 2018, however, the net present value for all giant field discoveries is available only after 1950 and their share to GDP only after 1960. It is expected that more giant fields will be discovered during the publication of this dataset, therefore observations after 2018 will be added in future updated versions of the dataset.

Discovery size: Giant oil and gas field discoveries are defined as those with estimated ultimate recovery (EUR) reserves greater or equal than 500 MMBOE. At the same time, all giant field discoveries are split into three sub-categories:

Giant – EUR are between 500 and 4,999 MMBOE

Supergiant – EUR are between 5,000 and 49,999 MMBOE

Megagiant – EUR are more than 50,000 MMBOE

UPDATES

We have updated the year of the discovery for 22 observations in the dataset published originally by Horn (2014). For these 22 observations we could not find a public source supporting that the giant field was discovered during the recorded year, but found public sources indicating a different year. We updated the year of the discovery according to the public source and inserted the link to the website containing this information in the [DISCO_SOURCE1] field. These 22 observations can be identified with the legend "Horn updated" in the [DISCO_SOURCE2] field.

This dataset contains giant field discoveries from 1868 to 2018, however, more observations after 2018 could be added in future updates. This current version includes 3 giant oil and gas field discovered in 2019.

SOURCING AND DISCLAIMER

All the data verted in this dataset comes from public datasets, oil and gas company websites, press release news, news articles, industry magazines, specialized blogs and research papers. All the sources used to build this dataset are inserted as web links below the DISCO_SOURCE1, DISCO_SOURCE2, DISCO_SOURCE3 and DISCO_SOURCE4 columns. Since all these web links are hosted by third parties, we are not responsible for their content, availability, free access or performance. Some of these websites might be already deleted, moved, updated or reported as unsafe. If this is the case, we suggest looking for alternative sources of data using a standard internet browser and the same giant field discovery data as keywords.

VARIABLES

FIELD_ID

A field ID with no specific sorting method used.

FLD_NAME

The name that is commonly used to refer to this field and that frequently appears in different sources used. This field name could have changed over time or it could vary from one source to another.

FLD_NAME2

The block name where the field was discovered or a second name also used to refer to this field but differ from the recorded under [FLD_NAME].

REG_NAME and REG_CODE

Region name and region code used in Horn (2014). The region names and their one-letter codes are: North America-A, Central and South America-B, Western Europe-C, Eastern Europe and former USSR-D, Middle East-E, Africa-F, Asia and Oceania-G. *Source: Horn (2014).*

WB_REGION

World Bank country groups by geographical region identified with their 3-letter codes. The regions definition and their codes are: EAP – East Asia & the Pacific, ECA – East Europe & Central Asia, LAC – Latin America & the Caribbean, MNA – Middle East & North Africa, SAR – South Asia and SSA – Sub-Saharan Africa. *Source: World Bank:*

<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

COUNTRY

Country common name. Joint discoveries made by two or more countries have the names of the countries involved. The dataset has in total 78 countries with at least one giant oil or gas field discovered.

CountrynameWEO - weo_code

Country name and 3-digit code defined in the World Economic Outlook (WEO) report. Missing values correspond to joint discoveries between two or more countries. *Source: IMF:*

<https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx>

ISO

ISO-3 letter country code. Missing values correspond to joint discoveries. *Source: UN:*

<https://unstats.un.org/unsd/tradekb/Knowledgebase/Country-Code>

STATE

Name of the state where the field was discovered. For USA, Canada and Mexico only, when available.

LAT_DD and LON_DD

Latitude and longitude in decimal degrees of the location where the field was discovered. Location coordinates are approximated, and the location accuracy may vary across fields and could be greater than one degree.

ON_OFF_LOC

Field location. Indicates whether the field is located onshore or offshore.

year

Year of the discovery. Year recorded from Horn (2014) or from other sources as indicated in the DISCO_SOURCE1 – DISCO_SOURCE4 columns.

FIELD_TYPE

Principal type of hydrocarbon discovered in the field that reaches the threshold of giant field discovery. Most of giant discoveries were oil fields (58.2%), followed by gas (41.6%) and 2 discoveries where both giant oil and gas resources were combined (0.2%).

SIZE_CLASS

Classification according to the size of the discovery in million barrels of oil equivalent (MMBOE): Giant (greater than 500 MMBOE but lower than 5,000 MMBOE), Supergiant (greater than 5,000 MMBOE but lower than 50,000 MMBOE) and Megagiant (greater than 50,000 MMBOE). These values were recorded from the sources listed in the DISCO_SOURCE1 – DISCO_SOURCE4 columns.

SIZE_CLASS_CODE

One-digit code indicating whether the observation corresponds to a Giant (1), Supergiant (2) or Megagiant (3) field discovery.

EUR_MMBOE

Estimated ultimate recovery (EUR) measured in million barrels of oil equivalent (MMBOE). The estimated ultimate recovery is defined as the sum of proven reserves at a specific period of time and the cumulative production up to that time (Morehouse, 2017). We use the EUR reported from the sources listed in DISCO_SOURCE1 – DISCO_SOURCE4 columns. Most sources report the amount of oil discovered in barrels of oil equivalent, no further calculations were used to report EUR for giant oil field discoveries. However, if the amount of oil discovered were reported in metric tons, we used the conversion ratio of 7.33 MMBOE to 1 million metric tons. Gas field EUR discoveries are typically reported in trillion cubic feet of natural gas (TCF) and these were converted to MMBOE using the conversion ratio of 200 MMBOE to 1 TCF, based on four oil and gas companies' reports and conversion tables, rounded to the nearest hundred¹. The lowest EUR value for all these discoveries is 500 MMBOE and the highest is 176,060 MMBOE corresponding to a field discovered in 1971 in Qatar.

oil_price

Crude oil prices in dollars per barrel from 1950 to 2018. These prices are calculated as the average of the three oil reference prices equally weighted in nominal US dollars. Years of data availability and sources are indicated in parenthesis:

1. Brent crude oil (1979-2018, [World Bank](#))
2. Arabian light (1950-1959, [Quandl](#)) and Dubai Fateh crude oil (1960-2018, [World Bank](#))

¹ The conversion formula used to convert trillion cubic feet (tcf) to million barrels of oil equivalent (MMBOE) varies according to different sources. For example, it can go from 167 MMBOE for 1 tcf of natural gas ([BP](#)) to 173 MMBOE ([Statoil](#)), 180 MMBOE ([ISU](#)) or 190 MMBOE ([Qatar Petroleum](#), [Israel Ministry of Energy](#)) for 1 tcf. For simplicity, we use the conversion factor of 1 tcf = 200 MMBOE.

3. WTI spot crude oil (1950-1981, [Federal Reserve Bank of St Louis](#)) and WTI crude oil (1982-2018, [World Bank](#))

gas_price

Gas prices in nominal US dollars per barrel of oil equivalent from 1950 to 2018. These prices were calculated as the average of US and Europe's natural gas prices from the US Energy Information Administration (EIA) and World Bank's Commodity Markets portal measured in dollars per million British thermal units (US\$/mmbtu). These values were converted to dollars per barrel (US\$/bbl) using the conversion ratio of 0.17 barrels of oil to 1 million British thermal units, based on four oil and gas companies' reports and conversion tables, rounded to the two decimal places². Years of data availability and sources are indicated in the parenthesis.

1. US natural gas price (1950-1959, [EIA](#); and 1959-2018, [World Bank](#))
2. European Union's natural gas price (1960-2018, [World Bank](#))

For the Europe's natural gas price, please consider that the calculations of prices have changed for some years: from April 2015 it uses the Netherlands Title Transfer Facility (TTF); from April 2010 to March 2015 it is calculated with the average import border price and a spot price component, including UK; and during June 2000 - March 2010 prices excludes UK.

firstdiscoyear

Year when the first oil or gas giant field was discovered in a country since 1868.

disco_cumu

Cumulative count of giant oil or gas fields discovered in a country since 1868 at the time of each giant oil or gas field discovery.

disco_count

Total count of giant fields discovered in a country between 1868 and 2018. If the country had giant discoveries in 2019, these were also considered.

EUR_cumu

Cumulative estimated ultimate recovery (EUR) resources in million barrels of oil equivalent (MMBOE) from giant oil and gas fields discovered by country since 1868.

² The conversion formula used to convert million British thermal units (mmbtu) to barrels (bbl) or barrels of oil equivalent (boe) varies according to different sources. For example, it can go from 0.165 boe for 1 mmbtu ([Statoil](#)) to 0.167 boe ([BP](#)), 0.17 boe ([ISU](#)) or 0.18 boe ([Qatar Petroleum](#)). We have set the conversion rate at 1 mmbtu = 0.17 boe.

NPV_USD_n

Net present value in nominal million US dollars calculated as the product of multiplying the net present value of the estimated ultimate recovery (EUR) measured in million barrels of oil equivalent (MMBOE) by oil or gas prices, depending on the field type. The net present value or NPV is defined as today's value of future cashflows over a period of time and using a certain discount rate.

defl_uscpi

Deflator used to convert nominal net present value to real net present value, corresponding to the US price level of household consumption deflator in 2011 dollars from 1950 to 2017 from the Penn World Table version 9.1. Source: <https://www.rug.nl/ggdc/productivity/pwt/>

NPV_USD_r

Net present value in real million 2011 US dollars calculated by dividing the nominal net present value [NPV_USD] by the deflator [defl_uscpi].

gdp_curr

Current gross domestic product in million US dollars. Source: *World Bank*, <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>

gdp_const

Gross domestic product in million constant 2010 US dollars. Source: *World Bank*, <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD>

NPV_GDP_n

Field discovery nominal net present value share of current GDP at the year of the oil or gas field discovery, calculated as $[NPV_USD_n]/[gdp_curr] \times 100$. Values are available from 1960 to 2017.

NPV_GDP_r

Field discovery real net present value (2011 US dollars) share of constant GDP (2010 US dollars) at the year of the discovery, calculated as $[NPV_USD_r]/[gdp_const] \times 100$. Values are available from 1960 to 2017.

DISCO_SOURCE1, DISCO_SOURCE2, DISCO_SOURCE3, DISCO_SOURCE4

Website link to the article, press release, blog or any other public access website with relevant information related to the giant field discovery and used to complete the discovered field data. The website links provide data on year of the discovery, size of the field, EUR discovered, location of the field and type of resource. All sources used were included up to a total of four sources.

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ANNEX

NPV calculation:

To compute the net present value [NPV_USD_n] of giant oil and gas field discoveries we follow Arezki et al (2016) method. We sum of the discounted gross revenues from the estimated ultimate recovery reserves amount [EUR_MMBOE] at the time of the discovery, starting after the fifth year of the discovery with an estimated plateau production, followed by an exponential decline and valued at current global oil or gas prices at the time of the discovery, until remaining reserves (RRR) drop to less than 1 MMBOE.

Production startup dates are unknown, thus we follow Arezki's et al (2016) estimation of five year delay from the year of the discovery to the startup date. Continuing with Arezki's et al (2016) calculation, we use an approximation of the production profile of a giant discovery and derive it using a field size dependent plateau production level q_p that is field size dependent and a maximum depletion rate of remaining reserves d_m .

The depletion rate of remaining reserves at time t is defined as:

$$d(t) = q(t)/RRR(t) ,$$

where $q(t)$ is annual production rate and $RRR(t) = EUR_{MMBOE} - Q(t)$, where $RRR(t)$ are remaining reserves and $Q(t)$ cumulative production.

We use the parameter estimates for plateau production (α, β) and maximum depletion rate (γ, δ) approximation functions for all pooled giant fields, where $\alpha = 0.57$, $\beta = 0.65$, $\gamma = 0.64$ and $\delta = -0.31$ (Arezki et al 2016).

The relationship between field size and plateau production q_p is defined as

$$q_p = \alpha [EUR_{MMBOE}]^\beta$$

and the relationship between field size and the depletion rate d_m as:

$$d_m = \gamma [EUR_{MMBOE}]^\delta$$

The duration of the production plateau will be defined by:

$$N = \frac{[EUR_{MMBOE}]}{q_p} - \frac{1}{d_m}$$

Therefore, the duration of the plateau production will depend on the size of the discovery indicated by the [EUR_MMBOE] variable.

Then, we calculate the net present value of the field's production measured in barrels multiplied by average world oil or gas prices. Since oil and gas prices follow a random walk process, we assume prices at the time of the discovery are the best price forecast. We assume a discount rate of 10 percent. The calculation of the nominal net present value of the giant discovery will be the sum of the discounted revenues from the estimated yearly production until remaining reserves fall lower than 1 MMBOE, defined as the exhaustion year:

$$nominal\ NPV_{i,t} = \sum_{t=1}^n \frac{q(t)*price}{(1+r)^t},$$

as long as $RRR < 1$, where price is oil or gas price depending on the field type.

To convert nominal to real values, we divide the net present value measured in current million US dollars [NPV_USD_n] by the deflator (2011=100) [defla_uscpi] from the Penn World Table version 9.1 to obtain real net present values in million 2011 US dollars [NPV_USD_r].