5CCS2INT - Introduction to Artificial Intelligence

EU Economics domain – modelling a basic economic environment with PDDL

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**Description**

Maintaining good quality of life amongst their members is a tough task for the EU. ‘Quality of life index’ is the quantifier for countries to keep track of how well their citizens live. We want a more unified and happier EU, so we have modelled a domain and problem file to uncover EU’s problems for computer scientist around the world. This problem is modelled for a simplified version of the early EU, which at that stage, had a slightly different economical structure. We have assumed however that every country is cooperative and eager to contribute for the greater good of the EU.

The goal state consists of each country reaching a certain level of quality of life. As such, each country will have to not only improve its own standing, but also cooperate with other countries, through trading, to ensure that every member of the EU will reach its goal state.

**Economic sectors**

Our planning divides the economic activity into three sectors: Resources, Industry and Services, as well as a ‘balance’ modelling the buying power of the country. A country can have a specific economic bias. Having an economic bias, as a country, means to be economically inclined towards growing and keeping more resources from that sector.

**Circulation of Currency, Goods and Services**

Countries can trade each other ‘economy points’ for funds. Internally, a country can grow resources by investing their funds into ‘economy points’. They can later use the ‘economy points’ to increase their quality of life. The goal is to reach a state where the country has surpassed a certain threshold for the ‘quality of life index’. After reaching the goal state, the country is considered to have come along with the EU standards of living. It is possible to trade multiple economy batches at the same time. That would be equivalent to sending multiple shipments from one country to the other, which is equivalent with what is happening in the real life.

**The flow is the following:**

*Funds (money) 🡨🡪 Economic sectors (resources, industry, services) 🡪 Quality of life*

Every bias is regulating a specific country’s trading habit. For instance, if Germany is resources biased, it is considered that it has enough resources internally and doesn’t need to buy them from another country. In this case Germany can only sell its resources to other countries. As for the other economic sectors, it can buy and sell as much as it wishes.

Each country has different prices for their resources and has different costs for increasing the ‘quality of life index’. There are parameters for how much of each resource is reduced by increasing the life quality in a country.

**Planning Model Description**

The types identified and modelled in the domain are the following:

* A **“Country”** type which represents the main entities interacting in the domain.

The predicates identified and modelled in the domain are as follows:

* **(is-not-resources-biased ?c - Country)** – determines the bias of a country towards trading resources. If a country is biased towards resources, it will not buy resources from another country, yet it will gladly sell resources to another country. The predicate has been negated to avoid negative preconditions.
* **(is-not-industry-biased ?c - Country)** – same as the previous predicate, but geared towards industry instead of resources.
* **(is-not-services-biased ?c - Country)**  – same as the previous predicate, but geared towards services instead of industry.
* **(is-not-growing-economy ?c - Country)** – this predicate is used to ensure that a **Country** cannot grow its economy twice at the same time. It has been negated to avoid negative preconditions.
* **(is-not-growing-quality-of-life ?c - Country)** – this predicate ensures that a **Country** cannot grow its quality of life twice at the same time. It has been negated to avoid negative preconditions.

The functions identified and defined in the domain can be split into two different categories: variables and constants. Variables can change over the course of the plan making process:

* **Variables**:
  + **(resources-sector ?c - Country)**
  + **(industry-sector ?c - Country)**
  + **(services-sector ?c - Country)** – this functions model the current standing of the economy of a certain country in terms of sectors, one function for each economic sector.
  + **(funds ?c - Country)** – this function represents the current ‘balance’ of a country
  + **(quality-of-life-index ?c - Country)** – used to represent the current quality-of-life-index value of the **Country**
* **Constants:**
  + **(resources-price ?c - Country)**
  + **(industry-price ?c - Country)**
  + **(services-price ?c - Country)** – this functions determine the price at which the country will sell its resources/industry/services points for to other countries
  + **(economy-growth-price ?c - Country)** – this function has the role of determining how much the country has to spend in order to generate new economy points
  + **(resources-growth ?c - Country)**
  + **(industry-growth ?c - Country)**
  + **(services-growth ?c - Country)** – functions used to specify how many economy points a country receives for each growth cycle
  + **(quality-index-resources-cost ?c - Country)**
  + **(quality-index-industry-cost ?c - Country)**
  + **(quality-index-services-cost ?c - Country))** – This functions determine how many economy points a country has to spend in order to gain a quality-of-life-index point over one development cycle

The durative actions identified and modelled in the domain:

* **trade-resources –** This action models an interaction between two countries where the first country buys resources from the second country. For the action to go through, the first country needs to not be biased towards buying resources and it should have enough funds to purchase 50 resource points at the price set by the second country. The second country should have at least 50 resource points. At the start of the trade, both countries will loose access to their funds and resource points respectively. The points and funds will be awarded back at the end of the action.
* **trade-industry –** Same as the previous action both with industry points instead of resource points.
* **trade-services –** Same as the previous action both with services points instead of industry points.
* **grow-economy –** This action represents a development cycle for the economy of a country. The country spends funds to gain economy points in each sector. It is not possible to grow your economy twice at the same time.
* **grow-quality-of-life –** This action models a development cycle for increasing the quality of life in a country. The country spends a certain number of each type of economy points to gain 1 point on the quality-of-life-index. It is not possible to grow the quality of life in a country twice at the same time.

**Resources**

Numbeo: https://www.numbeo.com/quality-of-life/rankings\_by\_country.jsp?title=2019&region=150

Wikipedia: <https://en.wikipedia.org/wiki/List_of_sovereign_states_in_Europe_by_GDP_(nominal)>

**Appendix: Domain file**

;domain file

(define (domain EU\_economics)

(:requirements :equality :typing :fluents :durative-actions)

(:types Country)

;fluents

(:functions

(resources-sector ?c - Country)

(industry-sector ?c - Country)

(services-sector ?c - Country)

(funds ?c - Country)

(quality-of-life-index ?c - Country)

(resources-price ?c - Country)

(industry-price ?c - Country)

(services-price ?c - Country)

(economy-growth-price ?c - Country)

(resources-growth ?c - Country)

(industry-growth ?c - Country)

(services-growth ?c - Country)

(quality-index-resources-cost ?c - Country)

(quality-index-industry-cost ?c - Country)

(quality-index-services-cost ?c - Country))

;predicates

(:predicates

(is-not-resources-biased ?c - Country)

(is-not-industry-biased ?c - Country)

(is-not-services-biased ?c - Country)

(is-not-growing-economy ?c - Country)

(is-not-growing-quality-of-life ?c - Country))

;predicates

(:predicates

(is-not-resources-biased ?c - Country)

(is-not-industry-biased ?c - Country)

(is-not-services-biased ?c - Country)

(is-not-growing-economy ?c - Country)

(is-not-growing-quality-of-life ?c - Country))

; c1 buys from c2

; RESOURCES

(:durative-action trade-resources

:parameters(?c1 ?c2 - Country)

:duration (= ?duration 1)

:condition(and(at start(is-not-resources-biased ?c1))

(at start(>= (funds ?c1) (\* 50 (resources-price ?c2))))

(at start(>= (resources-sector ?c2) 50))

(over all (not (= ?c1 ?c2))))

:effect(and(at start(decrease(funds ?c1) (\* 50 (resources-price ?c2))))

(at start(decrease(resources-sector ?c2) 50))

(at end(increase(funds ?c2) (\* 50 (resources-price ?c2))))

(at end(increase (resources-sector ?c1) 50))

)

)

; c1 buys from c2

; INDUSTRY

(:durative-action trade-industry

:parameters(?c1 ?c2 - Country)

:duration (= ?duration 1)

:condition(and (at start(is-not-industry-biased ?c1))

(at start(>= (funds ?c1) (\* 50 (industry-price ?c2))))

(at start(>= (industry-sector ?c2) 50))

(over all (not (= ?c1 ?c2)))

)

:effect(and(at start(decrease(funds ?c1) (\* 50 (industry-price ?c2))))

(at start(decrease(industry-sector ?c2) 50))

(at end(increase(funds ?c2) (\* 50 (industry-price ?c2))))

(at end(increase(industry-sector ?c1) 50))))

; c1 buys from c2

;SERVICES

(:durative-action trade-services

:parameters(?c1 ?c2 - Country)

:duration (= ?duration 1)

:condition(and (at start(is-not-services-biased ?c1))

(at start(>= (funds ?c1) (\* 50 (services-price ?c2) )))

(at start(>= (services-sector ?c2) 50))

(over all (not (= ?c1 ?c2)))

)

:effect(and(at start(decrease(funds ?c1) (\* 50 (services-price ?c2))))

(at start(decrease(services-sector ?c2) 50))

(at end(increase(funds ?c2) (\* 50 (services-price ?c2))))

(at end(increase(services-sector ?c1) 50))

)

)

; grow economy

(:durative-action grow-economy

:parameters(?c - Country)

:duration (= ?duration 1)

:condition(and(at start(>= (funds ?c) (economy-growth-price ?c)))

(at start(is-not-growing-economy ?c)))

:effect(and(at start(decrease(funds ?c) (economy-growth-price ?c)))

(at start(not(is-not-growing-economy ?c)))

(at end(increase(resources-sector ?c) (resources-growth ?c)))

(at end(increase(industry-sector ?c) (industry-growth ?c)))

(at end(increase(services-sector ?c) (services-growth ?c)))

(at end(is-not-growing-economy ?c))))

; grow quality of life

(:durative-action grow-quality-of-life

:parameters(?c - Country)

:duration(= ?duration 1)

:condition(and(at start(<= (quality-index-resources-cost ?c) (resources-sector ?c)))

(at start(<= (quality-index-industry-cost ?c) (industry-sector ?c)))

(at start(<= (quality-index-services-cost ?c) (services-sector ?c)))

(at start(is-not-growing-quality-of-life ?c)))

:effect(and(at start(not(is-not-growing-quality-of-life ?c)))

(at start(decrease(resources-sector ?c) (quality-index-resources-cost ?c)))

(at start(decrease(industry-sector ?c) (quality-index-industry-cost ?c)))

(at start(decrease(services-sector ?c) (quality-index-services-cost ?c)))

(at end(increase(quality-of-life-index ?c) 1))

(at end(is-not-growing-quality-of-life ?c))))

)

**Code: Problem file**

; problem file -- includes only a template for

; how countries are going to be represented in

; their initial state.

(define (problem problem1)

(:domain EU\_economics)

(:objects Belgium Germany France Italy Luxembourg Netherlands - Country) ; "name": "Belgium"

(:init

; -- Variables --

(=(resources-sector Belgium) 4) ; "resources": 4

(=(industry-sector Belgium) 108) ; "industry": 108

(=(services-sector Belgium) 400) ; "services": 400

(=(funds Belgium) 536) ; "funds": 536

(=(quality-of-life-index Belgium) 162) ; "quality-of-life-index": 162

; -- Constants --

(=(resources-price Belgium) 20) ; "resources": 20

(=(industry-price Belgium) 4) ; "industry": 4

(=(services-price Belgium) 2) ; "services": 2

(=(economy-growth-price Belgium) 30) ; "economy growth: " : 30

; -- Economy growth --

(=(resources-growth Belgium) 5) ; "resources": 5

(=(industry-growth Belgium) 10) ; "industry": 10

(=(services-growth Belgium) 15) ; "services": s15

; -- Quality of life growth --

(=(quality-index-resources-cost Belgium) 2) ; "resources": 2

(=(quality-index-industry-cost Belgium) 8) ; "industry": 8

(=(quality-index-services-cost Belgium) 12) ; "services": 12

;predicates initialised ; -- Biases --

(is-not-resources-biased Belgium) ; resources: false

(is-not-industry-biased Belgium) ; industry: false

(not(is-not-services-biased Belgium)) ; services: true

; -- Technical --

(is-not-growing-economy Belgium) ; "growing-eco": false

(is-not-growing-quality-of-life Belgium) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Germany) 1856) ; "resources": 1856

(=(industry-sector Germany) 1622) ; "industry": 1622

(=(services-sector Germany) 885) ; "services": 885

(=(funds Germany) 4029) ; "funds": 4029

(=(quality-of-life-index Germany) 187) ; "quality-of-life-index": 187

; -- Constants --

(=(resources-price Germany) 2) ; "resources": 2

(=(industry-price Germany) 2) ; "industry": 2

(=(services-price Germany) 15) ; "services": 15

(=(economy-growth-price Germany) 377) ; "economy growth: " : 377

; -- Economy growth --

(=(resources-growth Germany) 150) ; "resources": 150

(=(industry-growth Germany) 150) ; "industry": 150

(=(services-growth Germany) 100) ; "services": s100

; -- Quality of life growth --

(=(quality-index-resources-cost Germany) 126) ; "resources": 126

(=(quality-index-industry-cost Germany) 114) ; "industry": 114

(=(quality-index-services-cost Germany) 155) ; "services": 155

;predicates initialised ; -- Biases --

(not(is-not-resources-biased Germany)) ; resources: true

(is-not-industry-biased Germany) ; industry: false

(is-not-services-biased Germany) ; services: false

; -- Technical --

(is-not-growing-economy Germany) ; "growing-eco": false

(is-not-growing-quality-of-life Germany) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector France) 1254) ; "resources": 1254

(=(industry-sector France) 1126) ; "industry": 1126

(=(services-sector France) 809) ; "services": 809

(=(funds France) 2795) ; "funds": 2795

(=(quality-of-life-index France) 158) ; "quality-of-life-index": 158

; -- Constants --

(=(resources-price France) 2) ; "resources": 2

(=(industry-price France) 3) ; "industry": 3

(=(services-price France) 12) ; "services": 12

(=(economy-growth-price France) 154) ; "economy growth: " : 154

; -- Economy growth --

(=(resources-growth France) 100) ; "resources": 100

(=(industry-growth France) 100) ; "industry": 100

(=(services-growth France) 71) ; "services": s71

; -- Quality of life growth --

(=(quality-index-resources-cost France) 45) ; "resources": 45

(=(quality-index-industry-cost France) 55) ; "industry": 55

(=(quality-index-services-cost France) 62) ; "services": 62

;predicates initialised ; -- Biases --

(not(is-not-resources-biased France)) ; resources: true

(not(is-not-industry-biased France)) ; industry: true

(is-not-services-biased France) ; services: false

; -- Technical --

(is-not-growing-economy France) ; "growing-eco": false

(is-not-growing-quality-of-life France) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Italy) 703) ; "resources": 703

(=(industry-sector Italy) 1208) ; "industry": 1208

(=(services-sector Italy) 602) ; "services": 602

(=(funds Italy) 2087) ; "funds": 2087

(=(quality-of-life-index Italy) 146) ; "quality-of-life-index": 146

; -- Constants --

(=(resources-price Italy) 7) ; "resources": 7

(=(industry-price Italy) 2) ; "industry": 2

(=(services-price Italy) 8) ; "services": 8

(=(economy-growth-price Italy) 70) ; "economy growth: " : 70

; -- Economy growth --

(=(resources-growth Italy) 42) ; "resources": 42

(=(industry-growth Italy) 88) ; "industry": 88

(=(services-growth Italy) 23) ; "services": s23

; -- Quality of life growth --

(=(quality-index-resources-cost Italy) 40) ; "resources": 40

(=(quality-index-industry-cost Italy) 50) ; "industry": 50

(=(quality-index-services-cost Italy) 31) ; "services": 31

;predicates initialised ; -- Biases --

(is-not-resources-biased Italy) ; resources: false

(is-not-industry-biased Italy) ; industry: false

(not(is-not-services-biased Italy)) ; services: true

; -- Technical --

(is-not-growing-economy Italy) ; "growing-eco": false

(is-not-growing-quality-of-life Italy) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Luxembourg) 22) ; "resources": 22

(=(industry-sector Luxembourg) 28) ; "industry": 28

(=(services-sector Luxembourg) 46) ; "services": 46

(=(funds Luxembourg) 69) ; "funds": 69

(=(quality-of-life-index Luxembourg) 181) ; "quality-of-life-index": 181

; -- Constants --

(=(resources-price Luxembourg) 2) ; "resources": 2

(=(industry-price Luxembourg) 2) ; "industry": 2

(=(services-price Luxembourg) 2) ; "services": 2

(=(economy-growth-price Luxembourg) 5) ; "economy growth: " : 5

; -- Economy growth --

(=(resources-growth Luxembourg) 2) ; "resources": 2

(=(industry-growth Luxembourg) 3) ; "industry": 3

(=(services-growth Luxembourg) 2) ; "services": s2

; -- Quality of life growth --

(=(quality-index-resources-cost Luxembourg) 4) ; "resources": 4

(=(quality-index-industry-cost Luxembourg) 4) ; "industry": 4

(=(quality-index-services-cost Luxembourg) 4) ; "services": 4

;predicates initialised ; -- Biases --

(is-not-resources-biased Luxembourg) ; resources: false

(is-not-industry-biased Luxembourg) ; industry: false

(is-not-services-biased Luxembourg) ; services: false

; -- Technical --

(is-not-growing-economy Luxembourg) ; "growing-eco": false

(is-not-growing-quality-of-life Luxembourg) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Netherlands) 120) ; "resources": 120

(=(industry-sector Netherlands) 312) ; "industry": 312

(=(services-sector Netherlands) 540) ; "services": 540

(=(funds Netherlands) 910) ; "funds": 910

(=(quality-of-life-index Netherlands) 189) ; "quality-of-life-index": 189

; -- Constants --

(=(resources-price Netherlands) 11) ; "resources": 11

(=(industry-price Netherlands) 5) ; "industry": 5

(=(services-price Netherlands) 4) ; "services": 4

(=(economy-growth-price Netherlands) 25) ; "economy growth: " : 25

; -- Economy growth --

(=(resources-growth Netherlands) 3) ; "resources": 3

(=(industry-growth Netherlands) 10) ; "industry": 10

(=(services-growth Netherlands) 15) ; "services": s15

; -- Quality of life growth --

(=(quality-index-resources-cost Netherlands) 15) ; "resources": 15

(=(quality-index-industry-cost Netherlands) 57) ; "industry": 57

(=(quality-index-services-cost Netherlands) 225) ; "services": 225

;predicates initialised ; -- Biases --

(is-not-resources-biased Netherlands) ; resources: false

(is-not-industry-biased Netherlands) ; industry: false

(not(is-not-services-biased Netherlands)) ; services: true

; -- Technical --

(is-not-growing-economy Netherlands) ; "growing-eco": false

(is-not-growing-quality-of-life Netherlands) ; "growing-quality-of-life": false

)

(:goal (and

;todo: put the goal condition here

(>= (quality-of-life-index Belgium) 190)

(>= (quality-of-life-index Germany) 190)

(>= (quality-of-life-index France) 190)

(>= (quality-of-life-index Italy) 190)

(>= (quality-of-life-index Luxembourg) 190)

(>= (quality-of-life-index Netherlands) 190)

)

)

)

; -- Variables --

(=(resources-sector Germany) 1856) ; "resources": 1856

(=(industry-sector Germany) 1622) ; "industry": 1622

(=(services-sector Germany) 885) ; "services": 885

(=(funds Germany) 4029) ; "funds": 4029

(=(quality-of-life-index Germany) 187) ; "quality-of-life-index": 187

; -- Constants --

(=(resources-price Germany) 2) ; "resources": 2

(=(industry-price Germany) 2) ; "industry": 2

(=(services-price Germany) 15) ; "services": 15

(=(economy-growth-price Germany) 377) ; "economy growth: " : 377

; -- Economy growth --

(=(resources-growth Germany) 150) ; "resources": 150

(=(industry-growth Germany) 150) ; "industry": 150

(=(services-growth Germany) 100) ; "services": s100

; -- Quality of life growth --

(=(quality-index-resources-cost Germany) 126) ; "resources": 126

(=(quality-index-industry-cost Germany) 114) ; "industry": 114

(=(quality-index-services-cost Germany) 155) ; "services": 155

;predicates initialised ; -- Biases --

(not(is-not-resources-biased Germany)) ; resources: true

(is-not-industry-biased Germany) ; industry: false

(is-not-services-biased Germany) ; services: false

; -- Technical --

(is-not-growing-economy Germany) ; "growing-eco": false

(is-not-growing-quality-of-life Germany) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Germany) 1856) ; "resources": 1856

(=(industry-sector Germany) 1622) ; "industry": 1622

(=(services-sector Germany) 885) ; "services": 885

(=(funds Germany) 4029) ; "funds": 4029

(=(quality-of-life-index Germany) 187) ; "quality-of-life-index": 187

; -- Constants --

(=(resources-price Germany) 2) ; "resources": 2

(=(industry-price Germany) 2) ; "industry": 2

(=(services-price Germany) 15) ; "services": 15

(=(economy-growth-price Germany) 377) ; "economy growth: " : 377

; -- Economy growth --

(=(resources-growth Germany) 150) ; "resources": 150

(=(industry-growth Germany) 150) ; "industry": 150

(=(services-growth Germany) 100) ; "services": s100

; -- Quality of life growth --

(=(quality-index-resources-cost Germany) 126) ; "resources": 126

(=(quality-index-industry-cost Germany) 114) ; "industry": 114

(=(quality-index-services-cost Germany) 155) ; "services": 155

;predicates initialised ; -- Biases --

(not(is-not-resources-biased Germany)) ; resources: true

(is-not-industry-biased Germany) ; industry: false

(is-not-services-biased Germany) ; services: false

; -- Technical --

(is-not-growing-economy Germany) ; "growing-eco": false

(is-not-growing-quality-of-life Germany) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector France) 1254) ; "resources": 1254

(=(industry-sector France) 1126) ; "industry": 1126

(=(services-sector France) 809) ; "services": 809

(=(funds France) 2795) ; "funds": 2795

(=(quality-of-life-index France) 158) ; "quality-of-life-index": 158

; -- Constants --

(=(resources-price France) 2) ; "resources": 2

(=(industry-price France) 3) ; "industry": 3

(=(services-price France) 12) ; "services": 12

(=(economy-growth-price France) 154) ; "economy growth: " : 154

; -- Economy growth --

(=(resources-growth France) 100) ; "resources": 100

(=(industry-growth France) 100) ; "industry": 100

(=(services-growth France) 71) ; "services": s71

; -- Quality of life growth --

(=(quality-index-resources-cost France) 45) ; "resources": 45

(=(quality-index-industry-cost France) 55) ; "industry": 55

(=(quality-index-services-cost France) 62) ; "services": 62

;predicates initialised ; -- Biases --

(not(is-not-resources-biased France)) ; resources: true

(not(is-not-industry-biased France)) ; industry: true

(is-not-services-biased France) ; services: false

; -- Technical --

(is-not-growing-economy France) ; "growing-eco": false

(is-not-growing-quality-of-life France) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Italy) 703) ; "resources": 703

(=(industry-sector Italy) 1208) ; "industry": 1208

(=(services-sector Italy) 602) ; "services": 602

(=(funds Italy) 2087) ; "funds": 2087

(=(quality-of-life-index Italy) 146) ; "quality-of-life-index": 146

; -- Constants --

(=(resources-price Italy) 7) ; "resources": 7

(=(industry-price Italy) 2) ; "industry": 2

(=(services-price Italy) 8) ; "services": 8

(=(economy-growth-price Italy) 70) ; "economy growth: " : 70

; -- Economy growth --

(=(resources-growth Italy) 42) ; "resources": 42

(=(industry-growth Italy) 88) ; "industry": 88

(=(services-growth Italy) 23) ; "services": s23

; -- Quality of life growth --

(=(quality-index-resources-cost Italy) 40) ; "resources": 40

(=(quality-index-industry-cost Italy) 50) ; "industry": 50

(=(quality-index-services-cost Italy) 31) ; "services": 31

;predicates initialised ; -- Biases --

(is-not-resources-biased Italy) ; resources: false

(is-not-industry-biased Italy) ; industry: false

(not(is-not-services-biased Italy)) ; services: true

; -- Technical --

(is-not-growing-economy Italy) ; "growing-eco": false

(is-not-growing-quality-of-life Italy) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Luxembourg) 22) ; "resources": 22

(=(industry-sector Luxembourg) 28) ; "industry": 28

(=(services-sector Luxembourg) 46) ; "services": 46

(=(funds Luxembourg) 69) ; "funds": 69

(=(quality-of-life-index Luxembourg) 181) ; "quality-of-life-index": 181

; -- Constants --

(=(resources-price Luxembourg) 2) ; "resources": 2

(=(industry-price Luxembourg) 2) ; "industry": 2

(=(services-price Luxembourg) 2) ; "services": 2

(=(economy-growth-price Luxembourg) 5) ; "economy growth: " : 5

; -- Economy growth --

(=(resources-growth Luxembourg) 2) ; "resources": 2

(=(industry-growth Luxembourg) 3) ; "industry": 3

(=(services-growth Luxembourg) 2) ; "services": s2

; -- Quality of life growth --

(=(quality-index-resources-cost Luxembourg) 4) ; "resources": 4

(=(quality-index-industry-cost Luxembourg) 4) ; "industry": 4

(=(quality-index-services-cost Luxembourg) 4) ; "services": 4

;predicates initialised ; -- Biases --

(is-not-resources-biased Luxembourg) ; resources: false

(is-not-industry-biased Luxembourg) ; industry: false

(is-not-services-biased Luxembourg) ; services: false

; -- Technical --

(is-not-growing-economy Luxembourg) ; "growing-eco": false

(is-not-growing-quality-of-life Luxembourg) ; "growing-quality-of-life": false

; -- Variables --

(=(resources-sector Netherlands) 120) ; "resources": 120

(=(industry-sector Netherlands) 312) ; "industry": 312

(=(services-sector Netherlands) 540) ; "services": 540

(=(funds Netherlands) 910) ; "funds": 910

(=(quality-of-life-index Netherlands) 189) ; "quality-of-life-index": 189

; -- Constants --

(=(resources-price Netherlands) 11) ; "resources": 11

(=(industry-price Netherlands) 5) ; "industry": 5

(=(services-price Netherlands) 4) ; "services": 4

(=(economy-growth-price Netherlands) 25) ; "economy growth: " : 25

; -- Economy growth --

(=(resources-growth Netherlands) 3) ; "resources": 3

(=(industry-growth Netherlands) 10) ; "industry": 10

(=(services-growth Netherlands) 15) ; "services": s15

; -- Quality of life growth --

(=(quality-index-resources-cost Netherlands) 15) ; "resources": 15

(=(quality-index-industry-cost Netherlands) 57) ; "industry": 57

(=(quality-index-services-cost Netherlands) 225) ; "services": 225

;predicates initialised ; -- Biases --

(is-not-resources-biased Netherlands) ; resources: false

(is-not-industry-biased Netherlands) ; industry: false

(not(is-not-services-biased Netherlands)) ; services: true

; -- Technical --

(is-not-growing-economy Netherlands) ; "growing-eco": false

(is-not-growing-quality-of-life Netherlands) ; "growing-quality-of-life": false

)

(:goal (and

;todo: put the goal condition here

(>= (quality-of-life-index Belgium) 190)

(>= (quality-of-life-index Germany) 190)

(>= (quality-of-life-index France) 190)

(>= (quality-of-life-index Italy) 190)

(>= (quality-of-life-index Luxembourg) 190)

(>= (quality-of-life-index Netherlands) 190)

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