Investigating scientific mobility in co-authorship networks using multilayer temporal motifs: supplemental document

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A   Motif counting algorithms: definitions and pseudocode

This supplementary material provides details on relevant data structures and pseudocode of the algorithms presented in Section 4.

A.1   Edge motifs

Each edge in an edge motif can be described by its direction dir, denoting that the edge is from u to v (0) or from v to u (1), timestamp t, layer l and edge attribute p. As such, the final input sequences to the edge motif counting algorithm can be defined as

Definition S1. *Sequence S'' is a sequence of sets of sets of edges:*
$S'' = ((\{(\{e_1 = (dir_1, l_1), \ldots\}, p_1), \ldots\}, t_1), \ldots, ((\{\ldots, (\{\ldots, e_L = (dir_L, l_L)\}, p_P)\}, t_T))),$
such that $t_1 < t_2 < \ldots < t_T$ and for all $i \neq j$ with $1 \leq i, j \leq P$ we have $p_i \neq p_j$.

We define the following counters for the edge motif counting algorithm:

- nodes[dir, l] counts the number of times nodes u and v are connected with direction dir and layer l in the time window $[t_j - \delta, t_j)$

- conc_nodes[dir, l] counts the number of times nodes u and v are connected with direction dir and layer l at a given time t_i, i.e., the number of concurrent edges

- sum[dir_1, l_1, dir_2, l_2] counts the number of strictly ordered pairs of edges in $[t_j - \delta, t_j)$ with dir_i and l_i indicating the direction and layer of the respective edges

- pre_partial_sum[dir_1, l_1, dir_2, l_2] counts the number of strictly ordered pairs of edges, such that the first edge is in $[t_j - \delta, t_j)$ and the second edge is at time t_j, with dir_i and l_i indicating the direction and layer of the respective edges

- pre_conc_sum[dir_1, l_1, dir_2, l_2] counts the number of pairs of concurrent edges in $[t_j - \delta, t_j)$, with dir_i and l_i indicating the direction and layer of the respective edges

- conc_sum[dir_1, l_1, dir_2, l_2] counts the number of pairs of concurrent edges at a given time t_i, with dir_i and l_i indicating the direction and layer of the respective edges

- concurrent[dir_1, l_1, dir_2, l_2, dir_3, l_3] counts the full motifs of the 'concurrent' temporal configuration within δ time, with dir_1, dir_2 and dir_3 indicating the directional configuration and l_1, l_2 and l_3 indicating the layer configuration of the three edges

- pre_partial[dir_1, l_1, dir_2, l_2, dir_3, l_3], post_partial[dir_1, l_1, dir_2, l_2, dir_3, l_3] and serial[dir_1, l_1, dir_2, l_2, dir_3, l_3] analogues to the concurrent counter, but each matching their own temporal configuration.

The reformulated and extended edge motif counting algorithm is given in Algorithm S1.

Algorithm S1: Algorithm for counting the number of instances of all 2-node 3-edge δ-temporal λ-layer **edge motifs**. We assume counter indices are accessed in order of length. The ":" notation indicates element-wise operations on indices.

Input: Sequence (S'') of sets of sets of edges, with respectively equal timestamps (t) and edge attributes (p), with $t_1 < \ldots < t_T$, time window δ and $\forall_i : l_i \in \{0, \lambda - 1\}$:
$S'' = (coll_1 = (\{coll_{11} = (\{e_1 = (dir_1, l_1), \ldots\}, p_1), \ldots\}, t_1), \ldots,$
$(coll_T = (\{\ldots, (\{\ldots, e_L = (dir_L, l_L)\}, p_P)\}, t_T)))$
Output: Number of 2-node 3-edge δ-temporal λ-layer edge motifs M_{excl} in sequence S''

1   Initialize all counters to 0, start $\leftarrow 1$
2   **for** $j = 1, \ldots, T$ **do**
3   **while** $t_{start} < t_j - \delta$ **do**
4       $DecrementCounts(coll_{start}$, nodes, sum, pre_conc_sum)
5   start += 1
6     $IncrementCounts(coll_j$, nodes, sum, pre_conc_sum)

7   **return** concurrent, pre_partial, post_partial, serial
8   **Procedure** *DecrementCounts(colls, nodes, sum, pre_conc_sum)*
9   **for** *coll* **in** *colls* **do**
10   **for** $e = (dir, l)$ **in** *coll* **do** nodes[dir,l] $-= 1$
11   **for** *coll* **in** *colls* **do**
12   **for** $e = (dir, l)$ **in** *coll* **do**
13   sum[$dir,l,:,:$] $-=$ nodes[$:,:$]
14   pre_conc_sum[$:,:,dir,l$] $-=$ conc_nodes[$:,:$]
15   tmp_nodes[dir,l] $+= 1$
16   conc_nodes $\leftarrow$ tmp_nodes
17   **reset** conc_nodes, tmp_nodes

18   **Procedure** *IncrementCounts(colls, nodes, sum, pre_conc_sum)*
19   **for** *coll* **in** *colls* **do**
20   **for** $e = (dir, l)$ **in** *coll* **do**
21   concurrent[$:,:,:,:,dir,l$] $+=$ conc_sum[$:,:,:,:$]
22   pre_partial[$:,:,:,:,dir,l$] $+=$ pre_conc_sum[$:,:,:,:$]
23   post_partial[$:,:,:,:,dir,l$] $+=$ pre_partial_sum[$:,:,:,:$]
24   serial[$:,:,:,:,dir,l$] $+=$ sum[$:,:,:,:$]
25   tmp_sum[$:,:,dir,l$] $+=$ conc_nodes[$:,:$]
26   tmp_pp_sum[$:,:,dir,l$] $+=$ nodes[$:,:$]
27   tmp_nodes[dir,l] $+= 1$
28   conc_sum $\leftarrow$ tmp_sum, pre_partial_sum $\leftarrow$ tmp_pp_sum, conc_nodes $\leftarrow$ tmp_nodes
29   **for** *coll* **in** *colls* **do**
30   **for** $e = (dir, l)$ **in** *coll* **do** sum[$:,:,dir,l$] $+=$ nodes[$:,:$]
31   **for** *coll* **in** *colls* **do**
32   **for** $e = (dir, l)$ **in** *coll* **do** nodes[dir,l] $+= 1$
33   pre_conc_sum[$:,:,:,:$] $+=$ conc_sum[$:,:,:,:$]
34   **reset** conc_nodes, tmp_nodes, conc_sum, tmp_sum, pre_partial_sum, tmp_pp_sum

A.2 Algorithmic framework for star and triangle motifs

Algorithm S2: Algorithmic framework for counting of 3-node, 3-edge, δ-temporal, λ-layer star (and triangle) temporal motifs M.

Input: Sequence (S'') of sets of sets of edges, with respectively equal timestamps (t) and edge attributes (p), with $t_1 < \ldots < t_T$, time window δ and $\forall_i : l_i \in \{0, \lambda - 1\}$:
$S'' = (coll_1 = (\{coll_{11} = (\{e_1 = (nbr_1, dir_1, l_1), \ldots\}, p_1), \ldots\}, t_1), \ldots,$
$(coll_T = (\{\ldots, (\{\ldots, e_L = (nbr_L, dir_L, l_L)\}, p_P)\}, t_T)))$

1   Initialize all counters to 0, start $\leftarrow$ 1, end $\leftarrow$ 1
2   **for** $j = 1, \ldots, L$ **do**
3   **while** $t_{start} < t_j - \delta$ **do**
4   *Pop*(pre_nodes, pre_sum, pre_conc_sum, $coll_{start}$), start $+= 1$
5   **while** $t_{end} \leq t_j + \delta$ *and end* $< L$ **do**
6   *Push*(post_nodes, post_sum, post_conc_sum, $coll_{end}$), end $+= 1$
7   *Pop*(post_nodes, post_sum, post_conc_sum, $coll_j$)
8   *ProcessCurrent*(pre_nodes, post_nodes, mid_sum, pre_sum, post_sum, pre_conc_sum, post_conc_sum, $coll_j$)
9   *Push*(pre_nodes, pre_sum, pre_conc_sum, $coll_j$)

A.3 Star motifs

Each edge in a star motif can be described by its neighbour node *nbr*, its direction *dir* outward from (0) or inward to (1) center node *u*, timestamp *t*, layer *l* and edge attribute *p*. As such, the final input sequences to the star motif counting algorithm can be defined as

Definition S2. *Sequence S'' is a sequence of sets of sets of edges: $S'' = ((\{(\{e_1 = (nbr_1, dir_1, l_1), \ldots\}, p_1), \ldots\}, t_1), \ldots, ((\{\ldots, (\{\ldots, e_L = (nbr_L, dir_L, l_L)\}, p_P)\}, t_T))),$ such that $t_1 < t_2 < \ldots < t_T$ and for all $i \neq j$ with $1 \leq i, j \leq P$ we have $p_i \neq p_j$.*

We define the following counters for the star motif counting algorithm:

- pre_nodes[*dir*, *nbr*, *l*] counts the number of times neighbour *nbr* has appeared in an edge alongside *u* with direction *dir* and layer *l* in the time window $[t_j - \delta, t_j)$

- pre_sum[dir_1, l_1, dir_2, l_2] counts the number of strictly ordered pairs of parallel edges in $[t_j - \delta, t_j)$ with dir_i and l_i indicating the direction and layer of the respective edges

- pre_conc_sum[dir_1, l_1, dir_2, l_2] counts the number of pairs of concurrent parallel edges in $[t_j - \delta, t_j)$, with dir_i and l_i indicating the direction and layer of the respective edges

- post_nodes[*dir*, *nbr*, *l*], post_sum[dir_1, l_1, dir_2, l_2], post_conc_sum[dir_1, l_1, dir_2, l_2] analogues to the pre counters but for the time window $(t_j, t_j + \delta]$

- pre_partial_sum[dir_1, l_1, dir_2, l_2] counts the number of strictly ordered pairs of parallel edges such that the first edge is in $[t_j - \delta, t_j)$ and the second edge is at time t_j, with dir_i and l_i indicating the direction and layer of the respective edges

- post_partial_sum[dir_1, l_1, dir_2, l_2] counts the number of strictly ordered pairs of parallel edges such that the first edge is at time t_j and the second edge is in $(t_j, t_j + \delta]$, with dir_i and l_i indicating the direction and layer of the respective edges

- conc_nodes[dir, nbr, l] counts the number of times center node u and neighbour nbr are connected with direction dir and layer l at a given time t_i, i.e., the number of concurrent edges

- conc_sum[dir_1, l_1, dir_2, l_2] counts the number of pairs of concurrent parallel edges at a given time t_i, with dir_i and l_i indicating the direction and layer of the respective edges

- mid_sum[dir_1, l_1, dir_2, l_2] counts the number of pairs of parallel edges where the first edge is in direction dir_1, with layer l_1, and occurred at time $t \in (t_j - \delta, t_j)$ and the second edge is in direction dir_2, with layer l_2, and occurred at time $t' \in (t_j, t_j + \delta)$ such that $t' - t \leq \delta$

- conc[dir_1, l_1, dir_2, l_2, dir_3, l_3] counts the full motifs of the 'conc' temporal configuration within δ time, with dir_1, dir_2 and dir_3 indicating the directional configuration and l_1, l_2 and l_3 indicating the layer configuration of the three edges, respectively

- post_partial[dir_1, l_1, dir_2, l_2, dir_3, l_3], post_conc[dir_1, l_1, dir_2, l_2, dir_3, l_3], post[dir_1, l_1, dir_2, l_2, dir_3, l_3], pre_conc[dir_1, l_1, dir_2, l_2, dir_3, l_3], pre_partial[dir_1, l_1, dir_2, l_2, dir_3, l_3], mid[dir_1, l_1, dir_2, l_2, dir_3, l_3] and pre[dir_1, l_1, dir_2, l_2, dir_3, l_3] analogues to the 'conc' counter, but each matching their own temporal configuration.

The extended star motif counting algorithm is given in Algorithm S2 and S3.

Algorithm S3: Implementation of Algorithm S2 functions for counting 3-node, 3-edge, δ-temporal, λ-layer **star motif** instances.

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10 **Procedure** *Push(node_count, sum, conc_sum, colls)*
11   conc_nodes[:,:,:], tmp_nodes[:,:,:] $\leftarrow$ 0
12   **for** *coll* **in** *colls* **do**
13   **for** $e = (nbr, dir, l)$ **in** *coll* **do**
14   sum[:,:,dir,l] += node_count[:,nbr,:]
15   conc_sum[:,:,dir,l] += conc_nodes[:,nbr,:]
16   tmp_nodes[dir,nbr,l] += 1
17   conc_nodes $\leftarrow$ tmp_nodes
18   **for** *coll* **in** *colls* **do**
19   **for** $e = (nbr, dir, l)$ **in** *coll* **do** node_count[dir,nbr,l] += 1

20 **Procedure** *Pop(node_count, sum, conc_sum, colls)*
21   conc_nodes[:,:,:], tmp_nodes[:,:,:] $\leftarrow$ 0
22   **for** *coll* **in** *colls* **do**
23   **for** $e = (nbr, dir, l)$ **in** *coll* **do** node_count[dir,nbr,l] −= 1
24   **for** *coll* **in** *colls* **do**
25   **for** $e = (nbr, dir, l)$ **in** *coll* **do**
26   sum[dir,l,:,:] −= node_count[:,nbr,:]
27   conc_sum[:,:,dir,l] −= conc_nodes[:,nbr,:]
28   tmp_nodes[dir,nbr,l] += 1
29   conc_nodes $\leftarrow$ tmp_nodes

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30 Procedure *ProcessCurrent(pre_nodes, post_nodes, mid_sum, pre_sum, post_sum,*
  pre_conc_sum, post_conc_sum, colls)

31 $\quad$ conc_nodes[:,:,:], conc_sum[:,:,:,:], pre_partial_sum[:,:,:,:], post_partial_sum[:,:,:,:] $\leftarrow 0$

32 $\quad$ tmp_nodes[:,:,:], tmp_sum[:,:,:,:], tmp_pre_sum[:,:,:,:], tmp_post_sum[:,:,:,:] $\leftarrow 0$

33 $\quad$ **for** *coll* **in** *colls* **do**

34 $\quad\quad$ **for** $e = (nbr, dir, l)$ **in** *coll* **do** mid_sum[:,:,*dir*,*l*] $-=$ pre_nodes[:,*nbr*,:]

35 $\quad$ **for** *coll* **in** *colls* **do**

36 $\quad\quad$ **for** $e = (nbr, dir, l)$ **in** *coll* **do**

37 $\quad\quad\quad$ conc[:,:,:,:,*dir*,*l*] $+=$ conc_sum[:,:,:,:] $\qquad\qquad$ // $M_{s,1,x}$

38 $\quad\quad\quad$ post_partial[:,:,*dir*,*l*,:,:] $+=$ post_partial_sum[:,:,:,:] $\qquad$ // $M_{s,2,x}$

39 $\quad\quad\quad$ post_conc[*dir*,*l*,:,:,:,:] $+=$ post_conc_sum[:,:,:,:] $\qquad\quad$ // $M_{s,3,x}$

40 $\quad\quad\quad$ post[*dir*,*l*,:,:,:,:] $+=$ post_sum[:,:,:,:] $\qquad\qquad\qquad$ // $M_{s,4,x}$

41 $\quad\quad\quad$ pre_conc[:,:,:,:,*dir*,*l*] $+=$ pre_conc_sum[:,:,:,:] $\qquad\quad$ // $M_{s,5,x}$

42 $\quad\quad\quad$ pre_partial[:,:,:,:,*dir*,*l*] $+=$ pre_partial_sum[:,:,:,:] $\qquad$ // $M_{s,6,x}$

43 $\quad\quad\quad$ mid[:,:,*dir*,*l*,:,:] $+=$ mid_sum[:,:,:,:] $\qquad\qquad\qquad$ // $M_{s,7,x}$

44 $\quad\quad\quad$ pre[:,:,:,:,*dir*,*l*] $+=$ pre_sum[:,:,:,:] $\qquad\qquad\qquad$ // $M_{s,8,x}$

45 $\quad\quad\quad$ tmp_sum[:,:,*dir*,*l*] $+=$ conc_nodes[:,*nbr*,:]

46 $\quad\quad\quad$ tmp_post_sum[*dir*,*l*,:,:] $+=$ post_nodes[:,*nbr*,:]

47 $\quad\quad\quad$ tmp_pre_sum[:,:,*dir*,*l*] $+=$ pre_nodes[:,*nbr*,:]

48 $\quad\quad\quad$ tmp_nodes[*dir*,*nbr*,*l*] $+= 1$

49 $\quad\quad$ conc_nodes $\leftarrow$ tmp_nodes, conc_sum $\leftarrow$ tmp_sum

50 $\quad\quad$ post_partial_sum $\leftarrow$ tmp_post_sum, pre_partial_sum $\leftarrow$ tmp_pre_sum

51 $\quad$ conc_pre_nodes $\leftarrow$ conc_nodes, conc_mid_sum[:,:,:,:] $\leftarrow 0$

52 $\quad$ **reset** conc_nodes, tmp_nodes, conc_sum, tmp_sum, post_partial_sum, tmp_post_sum,
  pre_partial_sum, tmp_pre_sum

53 $\quad$ **for** *coll* **in** *colls.reverse* **do**

54 $\quad\quad$ **for** $e = (nbr, dir, l)$ **in** *coll* **do**

55 $\quad\quad\quad$ conc_pre_nodes[*dir*,*nbr*,*l*] $-= 1$

56 $\quad\quad\quad$ conc_mid_sum[*dir*,*l*,:,:] $-=$ conc_nodes[:,*nbr*,:]

57 $\quad\quad$ **for** $e = (nbr, dir, l)$ **in** *coll* **do**

58 $\quad\quad\quad$ conc[:,:,:,:,*dir*,*l*] $+=$ conc_sum[:,:,:,:] $\qquad\qquad$ // $M_{s,1,x}$

59 $\quad\quad\quad$ conc[:,:,:,:,*dir*,*l*] $+=$ conc_mid_sum[:,:,:,:] $\qquad\quad$ // $M_{s,1,x}$

60 $\quad\quad\quad$ post_partial[:,:,*dir*,*l*,:,:] $+=$ post_partial_sum[:,:,:,:] $\qquad$ // $M_{s,2,x}$

61 $\quad\quad\quad$ pre_partial[:,:,:,:,*dir*,*l*] $+=$ pre_partial_sum[:,:,:,:] $\qquad$ // $M_{s,6,x}$

62 $\quad\quad\quad$ tmp_sum[:,:,*dir*,*l*] $+=$ conc_nodes[:,*nbr*,:]

63 $\quad\quad\quad$ tmp_post_sum[*dir*,*l*,:,:] $+=$ post_nodes[:,*nbr*,:]

64 $\quad\quad\quad$ tmp_pre_sum[:,:,*dir*,*l*] $+=$ pre_nodes[:,*nbr*,:]

65 $\quad\quad\quad$ tmp_nodes[*dir*,*nbr*,*l*] $+= 1$

66 $\quad\quad$ **for** $e = (nbr, dir, l)$ **in** *coll* **do**

67 $\quad\quad\quad$ conc_mid_sum[:,:,*dir*,*l*] $+=$ conc_pre_nodes[:,*nbr*,:]

68 $\quad\quad$ conc_nodes $\leftarrow$ tmp_nodes, conc_sum $\leftarrow$ tmp_sum

69 $\quad\quad$ post_partial_sum $\leftarrow$ tmp_post_sum, pre_partial_sum $\leftarrow$ tmp_pre_sum

70 $\quad$ **for** *coll* **in** *colls* **do**

71 $\quad\quad$ **for** $e = (nbr, dir, l)$ **in** *coll* **do** mid_sum[*dir*,*l*,:,:] $+=$ post_nodes[:,*nbr*,:]

72 **return** conc, post_partial, post_conc, post, pre_conc, pre_partial, mid, pre

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A.4 Triangle motifs

Each edge in a triangle motif can be described by an indicator *uorv*, indicating whether it is connected to *u* (0) or *v* (1), its neighbour node *nbr*, its direction *dir* outward from (0) or inward to (1) *nbr*, timestamp *t*, layer *l* and edge attribute *p*. As such, the final input sequences to the triangle motif counting algorithm can be defined as

Definition S3. *Sequence S'' is a sequence of sets of sets of edges: $S'' = ((\{(\{e_1 = (uorv_1, nbr_1, dir_1, l_1), \ldots\}, p_1), \ldots\}, t_1), \ldots, ((\{\ldots, (\{\ldots, e_L = (uorv_L, nbr_L, dir_L, l_L)\}, p_P)\}, t_T))),$ such that $t_1 < t_2 < \ldots < t_T$ and for all $i \neq j$ with $1 \leq i, j \leq P$ we have $p_i \neq p_j$.*

The same set of counters as defined for star motifs in Section A.3, is used with minor adjustments. The one and two edge counters are given an additional index *uorv*, which indicates whether the first edge is connected to node *u* or *v* and, of course, a different set of counters is used for the full motifs matching the temporal configurations in Figure 8.

- conc[key_1, key_2, l_1, l_2, l_3] counts the full motifs of the 'conc' temporal configuration within δ time, with key_1, key_2 indicating the directional configuration and l_1, l_2 and l_3 indicating the layer configuration of the three edges, respectively

- pre_partial[key_1, key_2, l_1, l_2, l_3], post_partial[key_1, key_2, l_1, l_2, l_3] and serial[key_1, key_2, key_3, l_1, l_2, l_3] analogues to the 'conc' counter, but each matching their own temporal configuration.

The extended triangle motif counting algorithm is given in Algorithm S2 and S4. Unlike for edge and star motifs, the full motif counters use 'key's to indicate a specific directional configuration because we do not know to which node pair each triangle is assigned. Therefore, the algorithm must consider all three possibilities and map those to the same counter (lines 44–55 and lines 73–78). At the end of Algorithm S4 the key map translating the full motif counters to the configurations in Figure 2c is given.

Algorithm S4: Implementation of Algorithm S2 functions for counting 3-node, 3-edge, δ-temporal, λ-layer **triangle motifs** instances.

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10 **Procedure** *Push(node_count, sum, conc_sum, colls)*
11   conc_nodes[:,:,:], tmp_nodes[:,:,:] $\leftarrow 0$
12   **for** *coll* **in** *colls* **do**
13   **for** $e = (nbr, dir, uorv, l)$ **in** *coll* **do**
14   **if** $nbr \notin \{u, v\}$ **then**
15   sum[1-*uorv*,:,:,*dir*,*l*] += node_count[1-*uorv*,:,*nbr*,:]
16   conc_sum[1-*uorv*,:,:,*dir*,*l*] += conc_nodes[1-*uorv*,:,*nbr*,:]
17   tmp_nodes[*uorv*,*dir*,*nbr*,*l*] += 1
18   conc_nodes $\leftarrow$ tmp_nodes
19   **for** *coll* **in** *colls* **do**
20   **for** $e = (nbr, dir, uorv, l)$ **in** *coll* **do**
21   **if** $nbr \notin \{u, v\}$ **then** node_count[*uorv*,*dir*,*nbr*,*l*] += 1

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22 **Procedure** *Pop(node_count, sum, conc_sum, coll)*
23   conc_nodes[:,:,:], tmp_nodes[:,:,:] ← 0
24   **for** *coll* **in** *colls* **do**
25   **for** $e = (nbr, dir, uorv, l)$ **in** *coll* **do**
26   **if** $nbr \notin \{u,v\}$ **then** node_count[*uorv,dir,nbr,l*] −= 1

27   **for** *coll* **in** *colls* **do**
28   **for** $e = (nbr, dir, uorv, l)$ **in** *coll* **do**
29   **if** $nbr \notin \{u,v\}$ **then**
30   sum[*uorv,dir,l*,:,:] −= node_count[1-*uorv*,:,*nbr*,:]
31   conc_sum[1-*uorv*,:,:,*dir,l*] −= conc_nodes[1-*uorv*,:,*nbr*,:]
32   tmp_nodes[*uorv,dir,nbr,l*] += 1

33   conc_nodes ← tmp_nodes

34 **Procedure** *ProcessCurrent(pre_nodes, post_nodes, mid_sum, pre_sum, post_sum,*
    pre_conc_sum, post_conc_sum, colls)
35   conc_nodes[:,:,:,:], conc_sum[:,:,:,:,:], pre_partial_sum[:,:,:,:,:], post_partial_sum[:,:,:,:,:]
        ← 0
36   tmp_nodes[:,:,:,:], tmp_sum[:,:,:,:,:], tmp_pre_sum[:,:,:,:,:], tmp_post_sum[:,:,:,:,:] ← 0
37   **for** *coll* **in** *colls* **do**
38   **for** $e = (nbr, dir, uorv, l)$ **in** *coll* **do**
39   **if** $nbr \notin \{u,v\}$ **then** mid_sum[1-*uorv*,:,:,*dir,l*] −= pre_nodes[1-*uorv*,:,*nbr*,:]

40   **for** *coll* **in** *colls* **do**
41   **for** $e = (nbr, dir, uorv, l)$ **in** *coll* **do**
42   **if** $nbr \in \{u,v\}$ **then**
43   *utov* = (*nbr* == *u*) XOR *dir*
44   **for** $0 \le i, j \le 1$ **do**
45   conc[*i,j*,:,:,*l*] += conc_sum[1-*utov,i*,:,*j*,:]   // $M_{t,1,x}$
                                    + conc_sum[*utov,j*,:,*i*,:]
46   pre_partial[*i,j*,:,:,*l*] += pre_conc_sum[1-*utov,i*,:,*j*,:]   // $M_{t,2,x}$
                                    + pre_conc_sum[*utov,j*,:,*i*,:]
47   pre_partial[*i,j*,:,*l*,:] += post_partial_sum[(*utov* == *j*),1-*i*,:,0,:]
48   pre_partial[*i,j,l*,:,:] += post_partial_sum[(*utov* == *i*),1-*j*,:,1,:]
49   post_partial[*i,j,l*,:,:] += post_conc_sum[1-*utov,i*,:,*j*,:]   // $M_{t,3,x}$
                                  + post_conc_sum[*utov,j*,:,*i*,:]
50   post_partial[*i,j*,:,*l*,:] += pre_partial_sum[(*utov* ≠ *i*),1,:,1-*j*,:]
51   post_partial[*i,j*,:,:,*l*] += pre_partial_sum[(*utov* ≠ *j*),0,:,1-*i*,:]

52   **for** $0 \le i, j, k \le 1$ **do**
53   serial[*i*,:,*j,l,k*,:] += mid_sum[(*j* XOR *utov*),*i*,:,*k*,:]   // $M_{t,4,x}$
54   serial[*i,l,j*,:,*k*,:] += post_sum[(*i* XOR *utov*),*j*,:,1-*k*,:]
55   serial[*i*,:,*j*,:,*k,l*] += pre_sum[(*k* == *utov*),1-*i*,:,1-*j*,:]

56   **else**
57   tmp_sum[1-*uorv*,:,:,*dir,l*] += conc_nodes[1-*uorv*,:,*nbr*,:]
58   tmp_post_sum[*uorv,dir,l*,:,:] += post_nodes[1-*uorv*,:,*nbr*,:]
59   tmp_pre_sum[1-*uorv*,:,:,*dir,l*] += pre_nodes[1-*uorv*,:,*nbr*,:]
60   tmp_nodes[*uorv,dir,nbr,l*] += 1

61   conc_nodes ← tmp_nodes, conc_sum ← tmp_sum
62   post_partial_sum ← tmp_post_sum, pre_partial_sum ← tmp_pre_sum

```
63  │   conc_pre_nodes ← conc_nodes, conc_mid_sum[:,:,:,:] ← 0
64  │   reset conc_nodes, tmp_nodes, conc_sum, tmp_sum, post_partial_sum, tmp_post_sum,
    │     pre_partial_sum, tmp_pre_sum
65  │   for coll in colls.reverse do
66  │       for e = (nbr,dir,uorv), l in coll do
67  │           if nbr ∉ {u,v} then
68  │               conc_pre_nodes[uorv,dir,nbr,l] −= 1
69  │               conc_mid_sum[uorv,dir,l,:,:] −= conc_nodes[1-uorv,:,nbr,:]

70  │       for e = (nbr,dir,uorv,l) in coll do
71  │           if nbr ∈ {u,v} then
72  │               utov = (nbr == u) XOR dir
73  │               for 0 ≤ i, j ≤ 1 do
74  │                   conc[i,j,:,:,l] += conc_sum[1-utov,i,:,j,:]                    // M_{t,1,x}
    │                                    + conc_sum[utov,j,:,i,:]
    │                                    + conc_mid_sum[1-utov,i,:,j,:]
    │                                    + conc_mid_sum[utov,j,:,i,:]
    │                                                                                 // M_{t,2,x}
75  │                   pre_partial[i,j,:,l,:] += post_partial_sum[(utov == j),1-i,:,0,:]
76  │                   pre_partial[i,j,l,:,:] += post_partial_sum[(utov == i),1-j,:,1,:]
77  │                   post_partial[i,j,:,l,:] += pre_partial_sum[(utov ≠ i),1,:,1-j,:] // M_{t,3,x}
78  │                   post_partial[i,j,:,:,l] += pre_partial_sum[(utov ≠ j),0,:,1-i,:]
79  │           else
80  │               tmp_sum[1-uorv,:,:,dir,l] += conc_nodes[1-uorv,:,nbr,:]
81  │               tmp_post_sum[uorv,dir,l,:,:] += post_nodes[1-uorv,:,nbr,:]
82  │               tmp_pre_sum[1-uorv,:,:,dir,l] += pre_nodes[1-uorv,:,nbr,:]
83  │               tmp_nodes[uorv,dir,nbr,l] += 1

84  │       for e = (nbr,dir,uorv,l) in coll do
85  │           if nbr ∉ {u,v} then
86  │               conc_mid_sum[1-uorv,:,:,dir,l] += conc_pre_nodes[1-uorv,:,nbr,:]

87  │       conc_nodes ← tmp_nodes, conc_sum ← tmp_sum
88  │       post_partial_sum ← tmp_post_sum, pre_partial_sum ← tmp_pre_sum
89  │   for coll in colls do
90  │       for e = (nbr,dir,uorv,l) in coll do
91  │           if nbr ∉ {u,v} then mid_sum[uorv,dir,l,:,:] += post_nodes[1-uorv,:,nbr,:]

92  return conc, pre_partial, post_partial, serial
```

```
/* Key map to Figure 2c                                              */
/* conc:                                                             */
/* [0,0], [1,0], [1,1] ↦ M_{t,1,1},  [0,1] ↦ M_{t,1,2}               */
/* pre_partial:                                                      */
/* [0,0] ↦ M_{t,2,5},  [0,1] ↦ M_{t,2,2},  [1,0] ↦ M_{t,2,1},  [1,1] ↦ M_{t,2,3}   */
/* post_partial:                                                     */
/* [0,0] ↦ M_{t,3,4},  [0,1] ↦ M_{t,3,2},  [1,0] ↦ M_{t,3,3},  [1,1] ↦ M_{t,3,1}   */
/* serial:                                                           */
/* [0,0,0] ↦ M_{t,4,3},  [0,0,1] ↦ M_{t,4,4},  [0,1,0] ↦ M_{t,4,1},  [0,1,1] ↦ M_{t,4,2}  */
/* [1,0,0] ↦ M_{t,4,7},  [1,0,1] ↦ M_{t,4,8},  [1,1,0] ↦ M_{t,4,5},  [1,1,1] ↦ M_{t,4,6}  */
```

B   Country comparison

In Section 7 we have considered and compared fields in their entirety, but variations in co-authorship and mobility behaviour also occur within fields. To study these variations we first extracted country-specific datasets from the global datasets (see Section B.1). Then, we computed the relative importance (ri) of all categories for the 50 largest countries in each field, where country size is based on scientific output, i.e., the number of papers associated with the country. The relative importance of a category i in a given field j and country k with respect to all countries is determined, analogous to Equations 1 and 2, as:

$$ri_{i,j,k} = \frac{\frac{c_{i,j,k}}{c_{p(i),j,k}} - avg_{i,j}}{avg_{i,j}}, \text{ with } avg_{i,j} = \frac{1}{50} \sum_{k=1}^{50} \frac{c_{i,j,k}}{c_{p(i),j,k}}. \tag{S1}$$

We examine outlier countries that represent unique co-authorship and mobility behaviour and investigate commonalities between countries showing the same behaviour in Section B.2. We summarise our findings in Section B.3.

B.1   Country datasets

Extracting country specific networks from global co-authorship networks is for the most part straightforward. All organisational, local and national edges within a country are included for that country, requiring only a decision to be made regarding the international co-authorships. In a non-motif context, one could choose to simply include the co-authorship links that are directly tied to a given country. However, in a motif context where we always consider multiple connected edges together, co-authorships that are outside a country but directly connect to an international link to that country may very well still be of interest. This begs the question: which edges outside a country are still of interest to that country, within a motif context? Here, we choose to include all co-authorships of every paper of which at least one author is associated with a given country. This means we consider a co-authorship link relevant for a country as long as the paper on which it is based is associated with that country.

B.2   Results

The results, for $\delta = 10$ years, are shown in Tables S1–S5. In this section we first highlight some categories, countries and regions that show specific behaviour within the various fields and then discuss recurring patterns between the categories that recur over multiple fields.

Social sciences & Humanities

For Social sciences & Humanities (SSH) we observe geographical clustering of countries with positive and negative ri for mobility (M_{all}). Figure S1 shows that clusters of countries with negative ri exist in South-Eastern Europe (Italy, Croatia, Hungary, Serbia, Greece and Cyprus), South Asia (Malaysia, Thailand, India and Iran) and parts of the American continents (USA, Mexico, Colombia, Brazil). Note that Singapore forms an exception in South Asia with a positive ri of +1.47. Clusters of countries with positive ri for M_{all} can be found in Northern Europe (Ireland, Great Britain, Sweden and Estonia), Western Europe (Germany, France and Switzerland) and Eastern Europe (Romania, Slovakia, Czech Republic and Russia). Here exceptions occur for The Netherlands and Lithuania.

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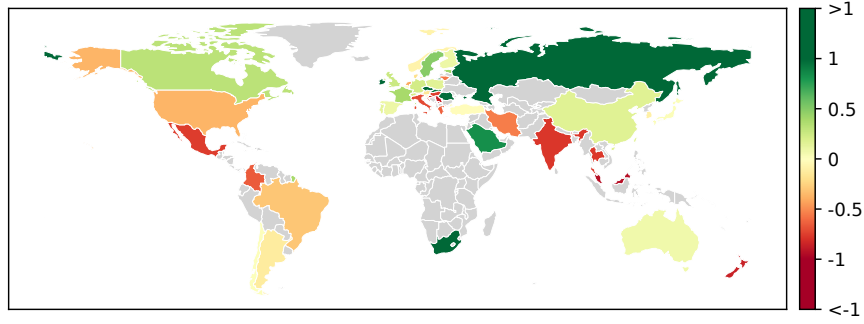
Figure S1: Relative importance of M_{all} of countries in Social sciences & Humanities

In Figure S2, we see that the Czech Republic has a very high proportion of continued collaboration (CC) and duo-mobility (M2) motifs, with an over four times higher proportion of CC motifs and nearly six times higher proportion of M2 motifs than on average in the field. Among the M2 motifs, they have a higher proportion of visit mobility (VM) than on average. Inversely, the Czech Republic has a smaller proportion of team collaborations (TC), i.e., triangle motifs. These results suggest that in the Czech Republic authors cling much more to their established knowledge network than that they expand it. As a result, a move by one author to another organisation may result in many visit mobility events from their established knowledge network.

Russia shows a high proportion of mobility motifs and among them M2 motifs form a greater proportion than on average, yet to a much smaller degree than the Czech Republic. What makes Russia unique though, is the strong negative ri for return or follow mobility (RFM) and visit mobility (VM). So, not only does Russia have more mobility motifs among the edge motifs, relatively few of them have a clear meaning. Along with a relatively small proportion of MSC motifs, this suggests that, as authors move to a new organisation, they maintain little of their knowledge network from their old organisation. However, they do continue to co-author with a few co-authors regardless of further mobility, but rarely does this inspire visit mobility or return or follow mobility between those co-authors. A similar, albeit weaker, pattern can be observed for Ireland.

Throughout all fields, Japan shows a decreased proportion of international collaboration
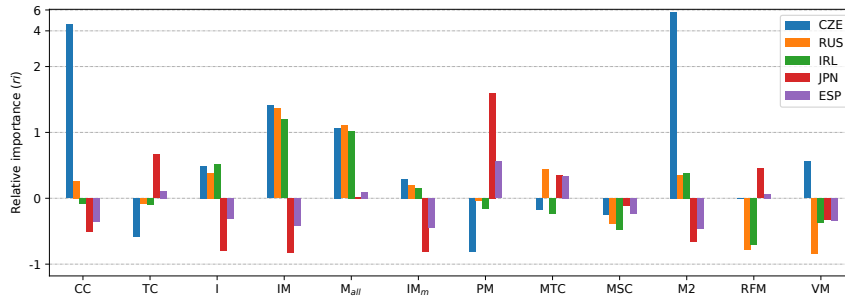
Figure S2: Relative importance of some categories and countries in Social sciences & Humanities

and international mobility motifs and a decreased proportion of mobility motifs usually accompanies this. However, in SSH, Japan has an average proportion of overall mobility motifs (M_{all} 0.02) with a very small proportion of international mobility (IM_m -0.82). In other words, authors in this field move relatively often between organisations within Japan itself and very rarely internationally. Spain, shows a similar, albeit weaker, pattern.

Biomedical & Health sciences

Like for SSH, for Biomedical & Health sciences (B&H), we see geographical clustering of countries based on the relative importance of M_{all}. In Figure S3 we observe a cluster of strong positive *ri* in Northern Europe with Great Britain, Sweden, Finland and Denmark, but see negative *ri* throughout the rest of Europe, with a cluster of strong negative *ri* in Eastern Europe (Lithuania, Poland, Slovenia, Serbia, Romania, Greece and Turkey). With the exception of Peru, we see negative *ri* throughout the American continents. On the other hand, South Asia is a mixed bag of strong positive and negative *ri*. Additionally, positive *ri* can be observed for Australia and the Middle East.

An observation that can be made for the field of B&H when you look at Table S2 in Appendix B, is that the proportion of international mobility motifs among all mobility motifs (IM_m) is closely related to the size of a country, where size is based on scientific output. We see that the largest countries have a tendency to have a smaller proportion of international mobility, whilst the smaller (perhaps less prominent) countries have a larger proportion of international mobility. One might interpret this as there being a brain drain, i.e., scholars moving primarily from less prominent countries to more prominent countries in the field and not the other way around. However, if there was a brain drain, then we would expect to see a greater proportion of outgoing international mobility (IMO) than incoming international mobility (IMI) for the smaller countries and vice versa for the more prominent countries. Figure S4 shows that there is no such phenomenon. In fact, most smaller countries with a large proportion of international mobility also display an above average proportion of M2 motifs with either a strong tendency towards return or follow mobility (RFM) or visit mobility (VM). We may take this as an indicator of brain circulation, where scholars either return to or visit their home country, thereby balancing the incoming and outgoing international mobility.
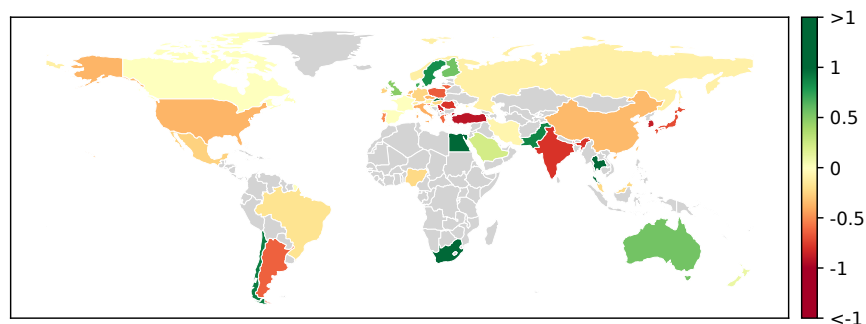
Figure S3: Relative importance of M_{all} of countries in Biomedical & Health sciences
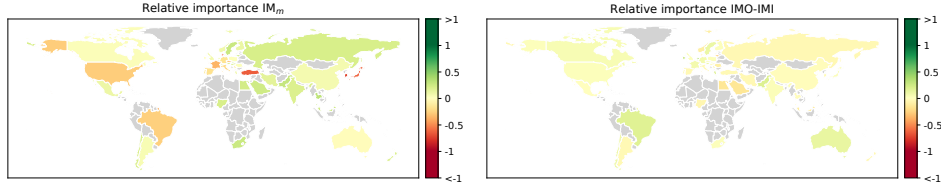
Figure S4: Relative importance of IM_m and the difference in relative importance between categories IMO and IMI of countries in Biomedical & Health sciences

Physical sciences & Engineering

For Physical sciences & Engineering (P&E), we see, again, a geographical clustering of countries with respect to the proportion of mobility motifs (M_{all}) in Figure S5. Similar to B&H, we see that Peru is the sole country on the American continents with a positive *ri*. Throughout South and West Asia we see countries with negative *ri* and we see strong positive *ri* in the Middle East. However, Iran has negative and Pakistan positive *ri*. In Europe we see clusters that combine parts of European regions, for example we see a cluster of negative *ri* for Portugal, Spain, France, Switzerland and Belgium, and a cluster of positive *ri* for The Netherlands, Germany, Poland and Sweden.

As shown in Figure S6, in P&E Slovenia is a country with relatively many team collaborations (TC) and an above average proportion of motifs that include an international co-authorship (I), but a low proportion of international mobility motifs (IM). Since Slovenia also has a very large proportion of equidistant partner motifs (EP) among the team collaborations, it stands to reason that authors in Slovenia in this field share relatively many international partners and do so largely whilst associated with different organisations. Furthermore, these inter-organisational co-authorships and shared international partners seem to have a negative impact on the proportion of mobility motifs, and equally so on international mobility. The same pattern, albeit weaker, emerges in this field for Canada. On the contrary, Slovakia sees the same pattern with respect to the proportions of team collaborations, international collaboration and mobility, but has a greater proportion of organisational equidistant partner motifs (OEP) than EP motifs.

Remarkably, Thailand has the greatest proportion of continued collaboration (CC) motifs, yet it has a below average proportion of duo-mobility (M2) motifs, a mobility type which we would expect to find above average given the large proportion of CC motifs. Furthermore,
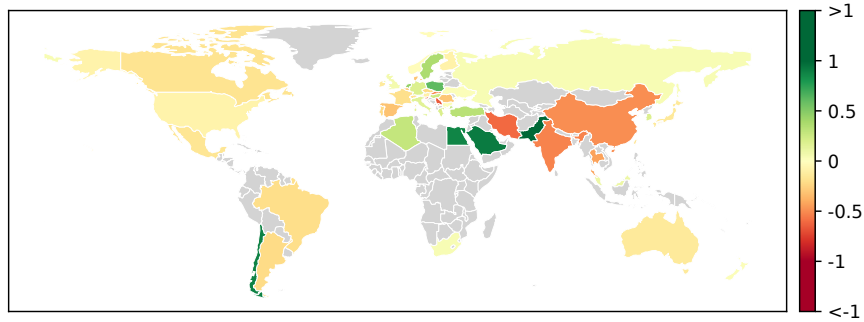
Figure S5: Relative importance of M_{all} of countries in Physical sciences & Engineering

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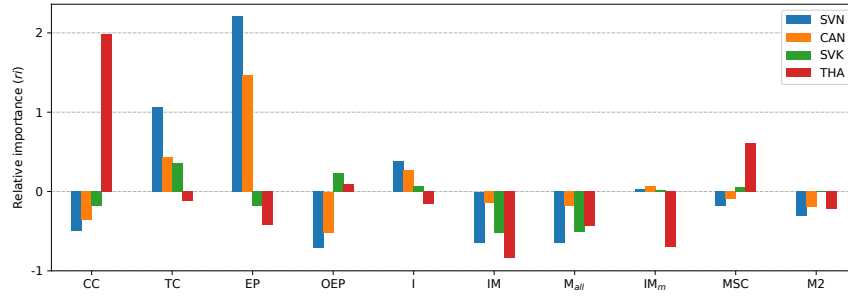
Figure S6: Relative importance of some categories and countries in Physical sciences & Engineering

international mobility (IM_m) motifs occur for Thailand at a far below average proportion with a greater proportion of MSC motifs. As such, we can surmise that authors in Thailand are likely to make fewer moves on average and are more likely to move within their own country whilst sustaining their scientific collaboration networks. This suggests a relatively high level of collaboration between (scholars at) the various scientific research organisations in Thailand that work in this field.

Life & Earth sciences

Geographical clustering of countries with respect to the proportion of mobility motifs (M_{all}) can also be observed for Life & Earth sciences (L&E). Figure S7 shows clusters with a relatively high proportion of mobility motifs in North America (Canada, USA), in Northern Europe (Great Britain, Norway, Sweden, Finland and Estonia), and Australia. Clusters with a relatively low proportion of mobility motifs appear in South America (Brazil, Argentina), Southern and Eastern Europe (Portugal, Spain, Italy, Austria, Slovenia, Croatia, Serbia, Greece, Romania, Hungary, Slovakia, Poland, Czech Republic). On the other hand, Asia and the Middle East form more of a mixed bag.

A surprising missing country in the clusters of negative tendency towards mobility for this field is Greece, which for SSH and B&H did show the same tendency as its neighbours in Southern Europe. For L&E, Greece actually shows an increased proportion mobility (M_{all}) motifs, as well as international collaboration (I) motifs. In fact, Figure S8 shows
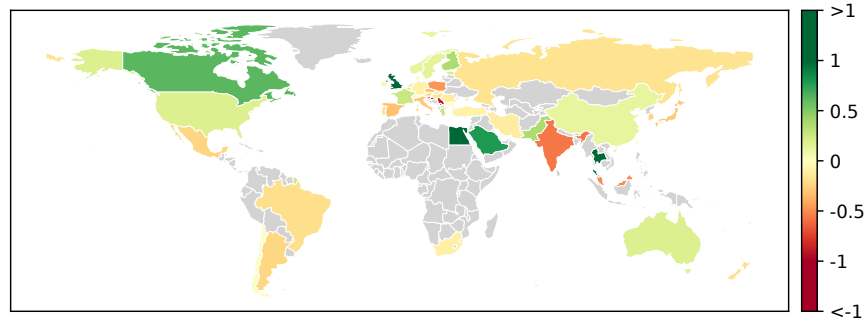
Figure S7: Relative importance of M_{all} of countries in Life & Earth sciences

13
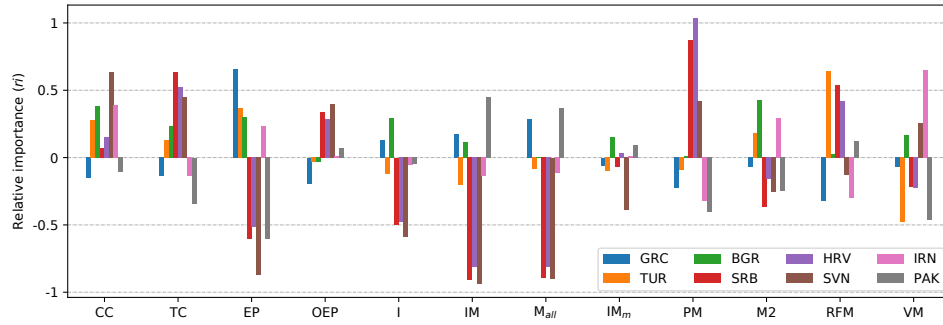
Figure S8: Relative importance of some categories and countries in Life & Earth sciences

that throughout most categories Greece shows the opposite tendencies with respect to its neighbouring countries (Turkey, Bulgaria, Serbia, Croatia and Slovenia).

Similar to the contradiction between Greece and its neighbour countries, neighbours Iran and Pakistan display inverse proportions of many categories. For example, Iran shows an above average proportion of continued collaboration (CC) and duo-mobility (M2) motifs and among the duo-mobility motifs they show the greatest tendency towards visit mobility (VM) over return or follow mobility (RFM) in the field. On the contrary, Pakistan shows the reverse tendency with a very small proportion of duo-mobility and among duo-mobility a very low proportion of visit mobility motifs.

Mathematics & Computer science

Figure S9 shows that the field of Mathematics & Computer science (M&S) also displays some geographical clustering based on the relative importance of M_{all}, but perhaps less than observed for the other fields. Notably, Northern Europe, which showed fairly consistent clustering for the other fields, forms a mixed bag as well as the American continents. Western Europe (Germany, The Netherlands, France, Switzerland, Austria and the Czech Republic) shows fairly consistent ri around zero, a type of clustering we have not seen before. Additionally, we see more negative ri in Southern Europe (Spain, Italy, Slovenia, Croatia and Serbia) and around the South and East of Asia (Japan, South-Korea, Malaysia, Thailand and India). Strong positive ri are again observed for the Middle East (Pakistan, Israel, Saudi Arabia and Egypt) with the exception of Iran, which is also the only of these countries to show a very small proportion of international mobility motifs instead of a relatively large proportion.

In Figure S10, we see that Serbia has a very high proportion of mobility motifs in the duo-mobility (M2) category. Unlike what we saw for the Czech Republic in SSH, it is associated with a much smaller positive ri for continued collaboration (CC) and Serbia has a relatively small proportion of visit mobility instead of a very larger proportion. Furthermore, we observed a strong positive ri for M_{all} for the Czech Republic in SSH, whilst Serbia has a consistently negative ri. Together with several other categories, this suggests that authors in Serbia form larger knowledge networks primarily at their own organisation, as evidenced by high ETC and low OEPC and OEPE, but that among mobile authors there is a far greater amount of continued collaboration, resulting in the observed high proportion of M2 motifs despite the low proportion of M_{all}.

Thailand is a special case in M&C. Like in P&E, it has the highest proportion of CC
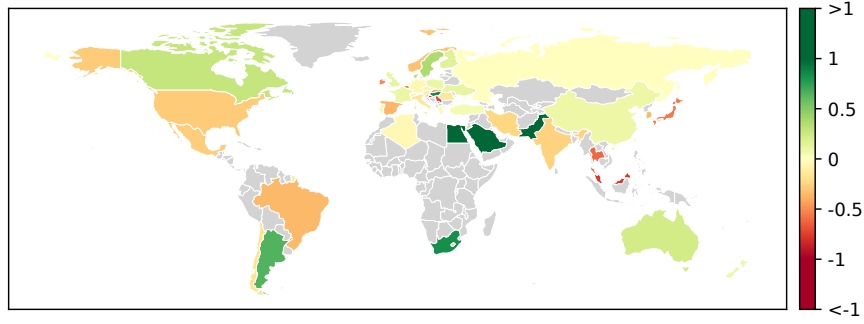
Figure S9: Relative importance of M_{all} of countries in Mathematics & Computer science

motifs, yet among mobility motifs the duo-mobility (M2) category is under-represented. Furthermore, like in P&E, it has a very low proportion of international mobility (IM$_m$), a high proportion of MSC, a low proportion of MTC and a low proportion of RFM motifs. Unlike in P&E though, Thailand has an above average proportion of international collaboration (I) motifs in M&C, as well as a high proportion of visit mobility (VM). This might suggest that, while our conclusion for Thailand in P&E holds up for M&C, the added international collaboration for Thailand in this field is characterized by international knowledge networks formed through foreign scholars that made short term visits to Thailand. Note that this behaviour is also supported by the high tendencies towards organisational equidistant partners where the organisational link, for example, the international visit, is the cause or effect of the equidistant partner (OEPC, OEPE).

A similar pattern can be observed for Malaysia with respect to the mobility categories, but here it represents an entirely different type of behaviour. After all, in Malaysia international collaboration (I) plays a much smaller role, equidistant team collaboration are far more prevalent (ETC) and far fewer organisational equidistant partnerships indicate a cause or effect on the formation of the partnership (OEPC, OEPE). This suggests that although similar mobility behaviour may be attributed to Malaysia, Malaysian authors are more likely to form teams and seek partnerships at their own organisations whereas authors from Thailand are more likely to form partnerships with foreign scholars.

By far the greatest divergence between the relative importances of incoming and outgoing international mobility (IMI and IMO) in any field, is observed for Denmark in M&C.
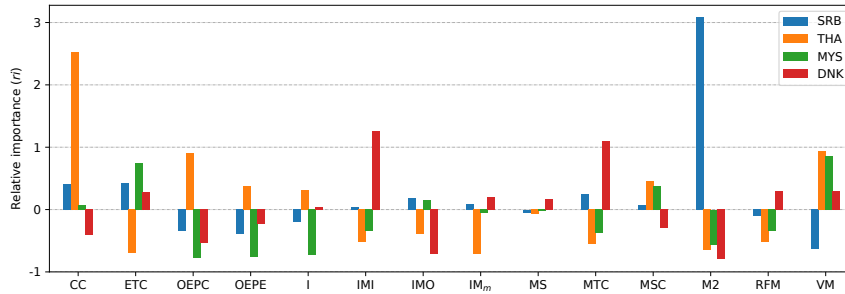
Figure S10: Relative importance of some categories and countries in Mathematics & Computer science

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Denmark is further characterized by the largest proportion of MTC motifs, the smallest proportion of duo-mobility (M2) motifs and one of the largest proportions of MS motifs in the field. Along with an increased likelihood of team collaboration being equidistant (ETC), we can surmise that Denmark in M&C may retain a (much) greater proportion of its incoming foreign scholars for a longer time than any other country in any of the fields.

Recurring patterns

For all fields, we see that a high positive (or negative) relative importance for MPEC correlates with a high positive (or negative) relative importance for M_{all}. In fact, over all 250 country and field combinations, the average difference between the ri for MPEC and M_{all} is only 0.06. The uncertainty of the equidistance in MPEC motifs comes from mobility events that might prevent the equidistance. As such, every MPEC motif implies a mobility event and the MPEC motifs make up approximately 50% of all mobility motifs in all of our experiments. Therefore, it is to be expected that the relative importance of the MPEC category is reflected in the M_{all} category. Despite this, it remains surprising just how close the categories correlate. In Figure S11, we can see the correlation between categories MPEC and M_{all} for SSH.

Figure S11 also shows a second pattern that reoccurs throughout all five fields. This pattern is marked by a positive correlation between the ri for the ETC and OEP categories. When they are both positive, we almost always see negative ri for the EP, OEPC, OEPE, I, IM and M_{all} categories. In other words, countries where scholars form more equidistant teams (ETC) and organisational equidistant partnerships (OEP), there are in fact relatively more teams formed within organisations and scholars perform relatively less international collaboration, less international mobility and less mobility overall. Note that this is relative to the number of co-authorships and not relative in time. After all, if in two countries a scholar moves on average once every three years, but during those three years scholars in one of those countries form far more co-authorships, then, in our computation, that country will have relatively less mobility. Furthermore, note that an increased proportion of OEP motifs inherently reduces the proportion of EP motifs and increases the likelihood of negative ri for EP. Additionally, note that teams within organisations are counted as both an ETC and OEP motif, but are not counted as OEPC nor OEPE motifs because, within organisations, previous co-authorships are a lot less likely to be the primary cause of future co-authorships. Thus, this pattern of negative relative importances for EP, OEPC and OEPE follows the logic of increased team collaboration at the organisational level.

This pattern informs us that team collaboration within organisations is relatively less conducive to international collaboration and (international) mobility. This relationship can of course exist in both directions. That is to say, if an author is less mobile then they are less likely to find new co-authors outside their organisation, both nationally and internationally, and if an author has fewer co-authors outside their organisation they are less likely to move to another organisation due to connections in their knowledge network.

There are of course countries that form the exception to the rule: in B&H, Russia has an average amount of international collaboration and mobility instead of below average; in P&E, Russia, South-Africa and Malaysia show average or above average (international) mobility; in L&E, China and Pakistan show above average (international) mobility and, in M&C, Poland, Russia and Sweden show (above) average (international) mobility.

When instead, both ETC and OEP are negative, we see positive ri for the same set of categories (EP, OEPC, OEPE, I, IM and M_{all}). This pattern tells us that when teams are formed they are more often formed with authors outside of the organisations and that
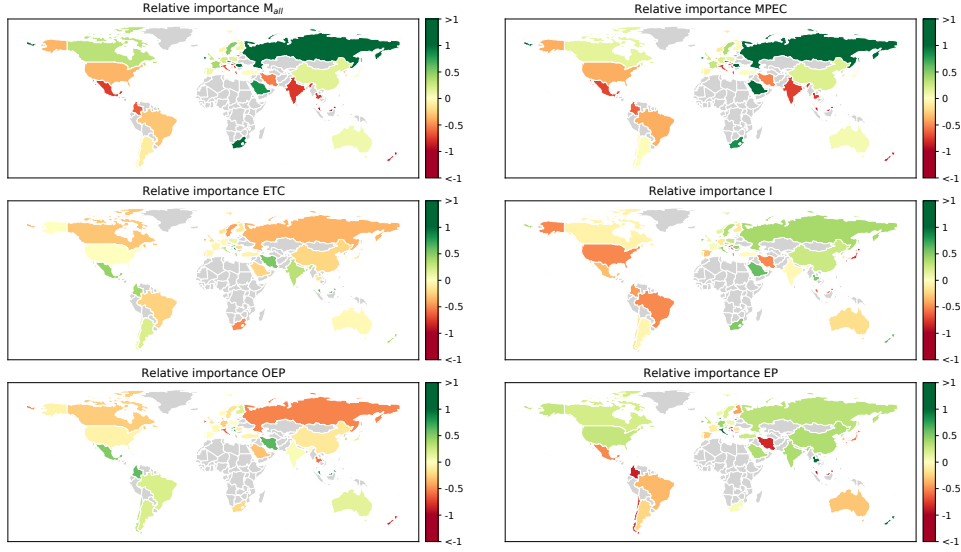
Figure S11: Relative importance of various categories for the 50 countries in the field of Social sciences & Humanities with the highest scientific output, with $\delta = 10$ years

these teams will more often involve foreign partners. Futhermore, it suggests that increased collaboration between organisations with foreign partners also facilitates relatively more international mobility and vice versa that international mobility allows for the creation of inter-organisational teams.

Exceptions here include: in SSH, Canada and Taiwan with (below) average international collaboration, respectively, and Thailand with below average (international) mobility; in B&H, Canada with average (international) mobility and Denmark with below average international collaboration and international mobility; in P&E, Denmark and Isreal with below average (international) mobility and, in L&E, Denmark and Austria with (below) average (international) mobility, respectively.

B.3   Summary

Here we have discussed countries with unique co-authorship and mobility behaviour as well as recurring patterns of between the categories. In short we made the following observations for the various fields.

- For Social sciences & Humanities (SSH), we showed that clusters of countries in South-Eastern Europe and South Asia have relatively less scientific mobility while clusters of countries in Northern, Western and Eastern Europe showed relatively more scientific mobility. We concluded that authors in the Czech Republic cling much more to their established knowledge networks than that they expand it, leading to more continued collaboration regardless of the occurrence of mobility. Finally, we showed that authors in Japan experience an average amount of mobility, but that a much greater proportion of that mobility is between organisation within Japan instead of international.

- For Biomedical & Health sciences (B&H), we found that, with the exception of

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Northern Europe, countries in Europe have relatively little mobility within B&H. The same is true for countries in North- and South-America, with the exception of Peru. We found that for B&H the largest countries, with respect to scientific output, showed a relatively small proportion of international mobility among all mobility, whilst the smaller (perhaps less prominent) countries have a relatively large proportion of international mobility. Additionally, we showed that the smaller countries have more visit mobility and return (or follow) mobility, indicating the presence of brain circulation where authors return to their home country.

- For Physical sciences & Engineering (P&E), we observed relatively less mobility throughout South and West Asia, while observing relatively more mobility in the Middle East. We reasoned that authors in Slovenia share relatively many international partners between authors at different organisations. However, these inter-organisational co-authorships and shared international partners seem to have a negative impact on overall mobility, and equally so on international mobility. Finally, we found that authors in Thailand are likely to make fewer moves on average and are more likely to move within their own country whilst sustaining their scientific knowledge networks, suggesting a relatively high level of collaboration between (scholars at) the various scientific research organisations in Thailand involved in P&E.

- For Life & Earth sciences (L&E), we found that clusters of countries in North America, Northern Europe and Australia showed relatively more mobility in L&E, whereas clusters of countries in South America, Southern and Eastern Europe showed relatively less mobility. Unlike in other fields, in L&E, Greece shows tendencies directly opposite that of their neighbouring countries with relatively more mobility and international collaboration.

- For Mathematics & Computer science (M&C), we found that, With the exception of Iran, the Middle East has relatively much scientific mobility in M&C. We concluded that authors in Serbia form larger knowledge networks primarily at their own organisation, but that among mobile authors there is a far greater amount of continued collaboration. For Thailand the same conclusion as for P&E holds up, but international collaboration for Thailand in this field appears to be characterized by international knowledge networks formed through foreign scholars that made short term visits to Thailand. The same mobility behaviour is observed for Malaysia. However, Malaysian authors are more likely to form teams and seek partnerships at their own organisations instead of with foreign scholars. Finally, we found that Denmark in M&C may retain a greater proportion of its incoming foreign scholars than any other country in any other field.

Additionally, throughout all field, we found that countries with increased team formation within organisations display relatively less international collaboration and (international) mobility. Conversely, countries that display an increased amount of inter-organisational team formation show relatively more international collaboration and (international) mobility.

Table S1: Relative importances of the categories for countries in Social sciences & Humanities for $\delta = 10$ years

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	4,609,814	452	0.01	0.90	0.46	0.07	0.08	0.04	0.03	0.01	0.00	0.04	0.01	0.01	0.33	0.09	0.03	0.04	0.15	0.09	0.15	0.13	0.05	0.06	0.01	0.00	0.01	0.00	0.00	0.00
USA	2,262,767	549	-0.41	0.02	-0.09	-0.40	-0.09	0.00	0.28	0.18	-0.26	-0.09	-0.03	0.12	-0.51	-0.60	-0.07	0.12	-0.36	-0.34	0.00	-0.00	-0.05	-0.01	0.03	-0.30	0.22	-0.33	-0.03	-0.14
GBR	694,382	235	-0.25	0.03	-0.19	0.23	-0.25	-0.18	0.25	0.15	0.25	-0.16	0.20	0.21	0.11	0.18	0.11	0.04	0.26	-0.00	0.00	0.03	-0.02	0.02	-0.39	-0.11	-0.02	-0.06	-0.01	0.16
CAN	418,643	286	-0.31	-0.00	-0.19	0.13	0.08	-0.31	0.21	0.50	0.26	-0.27	0.26	0.22	-0.08	0.21	-0.13	0.14	0.31	-0.02	0.00	-0.02	0.04	-0.06	0.25	-0.30	-0.27	-0.12	-0.37	-0.42
DEU	395,401	352	-0.32	0.02	-0.14	0.19	-0.14	-0.04	0.42	-0.17	-0.48	-0.27	0.28	0.23	-0.16	0.07	-0.01	0.12	0.22	-0.07	-0.00	0.02	-0.04	0.02	-0.24	-0.32	0.12	0.14	-0.33	-0.26
AUS	348,347	227	-0.26	0.02	-0.10	0.06	-0.12	-0.03	-0.30	0.28	-0.02	0.15	-0.19	-0.09	-0.19	-0.10	0.21	-0.13	0.07	-0.11	0.00	0.01	0.02	-0.00	-0.15	0.04	0.01	-0.27	-0.21	0.23
NLD	339,059	689	-0.44	0.04	-0.06	-0.42	-0.25	0.14	-0.33	0.46	-0.05	0.21	-0.42	-0.37	-0.38	-0.51	-0.00	0.11	-0.40	-0.13	0.00	-0.01	-0.04	0.02	0.10	0.08	0.12	0.49	0.14	0.03
CHN	226,770	71	0.11	0.03	-0.13	0.19	-0.28	-0.24	0.35	0.39	0.82	-0.14	0.27	0.31	0.26	0.25	0.20	-0.03	0.16	0.14	-0.00	0.04	-0.03	0.04	-0.52	-0.18	-0.15	0.52	-0.16	0.31
ESP	222,105	216	-0.36	-0.00	-0.11	-0.07	0.11	-0.06	-0.28	0.20	0.13	-0.01	-0.35	-0.17	-0.31	-0.42	-0.16	0.08	0.10	-0.44	0.00	-0.05	-0.19	0.13	0.56	0.34	-0.24	-0.46	0.06	-0.34
ITA	210,865	477	0.22	-0.03	0.25	-0.77	0.26	0.31	1.54	-0.42	0.07	-0.66	0.32	0.18	0.44	-0.83	0.05	-0.02	-0.72	-0.35	0.00	-0.01	0.02	-0.04	0.15	0.12	-0.06	-0.06	0.09	-0.43
FRA	195,373	90	-0.18	0.03	-0.14	0.27	-0.20	-0.07	-0.13	-0.06	-0.00	-0.04	-0.13	-0.18	0.04	0.32	-0.07	0.12	0.38	0.02	0.00	0.02	0.04	-0.02	-0.21	-0.14	-0.04	-0.12	0.02	-0.37
SWE	134,514	395	-0.00	0.02	-0.30	0.37	-0.21	-0.43	0.20	0.57	0.78	-0.17	0.55	0.51	0.34	0.65	0.18	-0.04	0.50	0.17	-0.00	0.03	-0.07	0.08	-0.38	-0.13	-0.37	0.34	0.04	0.21
CHE	119,528	186	-0.33	0.01	-0.02	0.27	0.01	0.02	0.37	-0.37	-0.21	-0.24	0.16	-0.07	0.32	0.31	0.03	0.00	0.21	0.15	0.00	0.03	0.02	-0.00	-0.33	-0.01	0.08	-0.35	0.24	-0.08
BEL	112,156	277	-0.43	0.03	-0.03	0.08	-0.20	0.11	0.23	-0.39	-0.32	-0.09	-0.08	0.01	0.15	0.10	0.08	0.04	-0.00	0.16	0.00	0.03	0.02	-0.00	-0.33	-0.01	0.08	-0.35	0.24	-0.08
JPN	102,284	295	-0.51	-0.06	-0.02	0.03	0.66	-0.15	-0.56	1.14	0.18	0.14	-0.36	-0.12	-0.80	-0.82	-0.24	-0.03	0.02	-0.82	0.00	-0.13	0.01	-0.12	1.60	0.34	-0.11	-0.66	0.45	-0.33
TWN	54,248	101	0.12	0.00	-0.19	-0.04	-0.04	-0.51	-0.19	1.36	0.22	-0.18	0.39	0.24	-0.21	0.17	-0.17	-0.01	0.16	0.07	0.00	-0.05	0.26	-0.24	0.66	-0.10	-0.25	-0.37	0.14	-0.21
KOR	62,022	36	-0.23	0.03	-0.01	-0.14	-0.21	0.02	-0.32	-0.16	-0.12	0.21	-0.25	-0.00	-0.15	-0.14	0.18	-0.26	-0.09	-0.00	0.00	0.03	-0.00	-0.01	-0.43	-0.03	-0.10	-0.51	0.13	-0.38
ISR	60,720	67	-0.01	-0.03	-0.19	0.13	-0.23	-0.33	0.24	0.60	0.83	-0.22	0.28	0.27	0.16	0.07	0.25	-0.11	0.18	-0.03	-0.00	-0.14	0.13	-0.04	-0.18	0.02	-0.05	0.20	-0.08	-0.34
BRA	82,995	52	-0.39	-0.01	-0.12	-0.39	0.17	-0.25	-0.35	1.38	0.46	0.20	-0.03	0.13	-0.50	-0.71	-0.22	-0.07	-0.31	-0.56	0.01	-0.05	-0.21	0.05	0.60	0.10	-0.01	-0.71	-0.13	0.07
NOR	78,131	97	-0.29	0.01	-0.06	-0.13	0.01	-0.17	0.08	0.02	0.14	-0.01	0.19	0.05	0.13	-0.09	0.12	-0.07	-0.08	0.05	0.00	-0.06	-0.06	-0.20	-0.25	-0.32	-0.23			
ZAF	60,570	169	-0.32	0.04	-0.19	0.83	-0.25	-0.51	0.05	-0.03	0.34	-0.22	0.40	0.62	0.50	1.24	-0.05	-0.26	1.03	0.17	0.00	0.03	-0.11	-0.03	-0.40	-0.18	-0.37	-0.38	-0.38	-0.12
FIN	80,721	409	-0.49	0.01	-0.19	-0.03	0.07	-0.15	-0.44	0.80	0.78	-0.17	-0.19	-0.14	-0.13	0.02	0.26	-0.12	-0.09	-0.01	-0.00	-0.00	-0.05	0.01	0.19	-0.05	-0.16	-0.36	-0.37	-0.20
DNK	74,133	155	-0.42	-0.00	0.02	-0.16	0.13	-0.02	0.97	-0.14	-0.14	-0.42	0.63	0.73	0.38	-0.21	0.07	-0.01	-0.20	0.04	0.00	0.02	0.01	0.01	-0.24	0.16	-0.05	-0.32	-0.17	-0.00
TUR	41,516	24	0.55	0.01	-0.08	0.02	-0.21	-0.08	0.26	0.18	0.12	-0.07	-0.16	0.24	-0.02	-0.10	0.25	-0.35	-0.01	-0.03	0.00	0.03	0.15	-0.12	-0.39	0.02	0.07	-0.28	-0.51	0.97
NZL	50,698	1,175	0.26	-0.04	0.37	-0.87	0.29	0.38	1.93	-0.42	0.09	-0.83	0.73	0.82	0.63	-0.88	0.14	-0.08	-0.86	-0.11	-0.00	0.04	-0.00	0.07	-0.50	0.10	-0.04	0.12	0.05	0.42
PRT	51,362	105	0.17	-0.00	-0.05	0.09	-0.01	-0.24	-0.16	0.76	0.61	0.01	0.08	-0.01	0.16	0.08	0.15	-0.09	0.13	0.01	-0.00	0.00	0.11	-0.07	0.10	-0.10	-0.03	0.30	-0.47	0.08
AUT	64,879	193	-0.36	-0.00	-0.06	-0.09	0.10	-0.06	0.43	-0.17	-0.02	-0.14	0.38	0.12	0.31	-0.10	-0.09	0.18	-0.16	0.14	0.00	0.02	-0.04	0.05	-0.21	0.06	0.05	-0.17	-0.13	-0.01
SGP	38,924	237	-0.17	0.02	-0.25	1.49	-0.12	-0.49	-0.37	-0.18	-0.21	-0.18	0.56	0.44	0.39	1.59	0.14	-0.11	1.27	0.21	0.00	-0.06	0.14	-0.09	0.27	0.02	-0.20	0.21	0.09	
IRL	48,114	412	-0.08	0.01	-0.18	0.85	-0.10	-0.38	0.54	0.30	0.41	-0.56	0.78	0.60	0.52	1.19	0.14	-0.02	1.02	0.16	0.00	-0.06	-0.03	-0.15	-0.24	-0.48	0.39	-0.70	-0.37	
GRC	38,452	90	0.13	-0.03	0.29	-0.70	0.25	0.40	-0.30	-0.67	-0.73	0.34	-0.84	-0.82	-0.51	-0.74	0.06	0.05	-0.64	-0.24	0.00	-0.02	-0.15	0.12	0.29	-0.26	0.16	-0.06	-0.04	0.20
POL	33,372	57	-0.11	0.02	-0.03	0.12	-0.14	0.11	0.09	-0.45	-0.35	-0.01	-0.15	-0.13	0.28	0.29	-0.10	0.02	0.16	0.18	0.00	0.03	0.01	0.09	-0.39	-0.12	-0.07	-0.06	-0.51	-0.23
CZE	20,190	128	4.53	-0.06	-0.14	1.02	-0.59	-0.32	0.26	-0.01	0.09	-0.03	0.27	0.20	0.49	1.41	0.11	0.10	1.07	0.29	-0.04	0.07	0.09	0.07	-0.81	-0.17	-0.26	5.75	-0.00	0.56
CHL	18,894	16	0.13	-0.02	0.00	-0.03	0.18	0.06	-0.75	0.47	0.45	0.32	-0.37	-0.42	-0.17	-0.01	0.02	-0.12	0.02	0.03	-0.00	-0.04	-0.12	0.21	0.55	-0.13	0.24	0.28	0.45	0.06
IRN	15,516	9	-0.11	-0.01	0.23	-0.52	0.10	0.52	-0.82	0.45	0.63	0.63	-0.71	-0.67	-0.52	-0.54	-0.13	0.10	-0.54	0.07	0.00	0.01	0.01	-0.07	-0.28	0.27	-0.25	0.02	0.28	
RUS	19,163	196	0.26	-0.00	-0.17	1.00	-0.08	-0.37	0.31	0.24	0.67	-0.52	0.04	0.34	0.38	1.37	0.09	-0.21	1.10	0.20	-0.00	0.00	0.07	-0.05	-0.04	0.44	-0.38	0.35	-0.78	-0.85
ROU	16,342	89	-0.37	0.05	-0.18	1.23	-0.41	-0.22	-0.20	-0.85	-0.84	-0.13	0.44	0.19	0.44	1.33	0.14	-0.06	0.98	0.25	0.00	0.04	0.13	0.00	-0.46	0.09	0.20	-0.55	0.23	0.28
HRV	22,399	15	-0.31	-0.01	0.32	-0.84	0.17	0.58	-0.26	-0.71	-0.56	0.36	-0.60	-0.68	-0.51	-0.93	-0.64	0.41	-0.84	-0.54	0.01	-0.04	-0.03	-0.10	0.44	-0.12	-0.23	-0.71	1.74	1.00
MYS	14,706	473	0.10	-0.03	0.40	-0.92	0.22	0.60	-0.96	-0.06	-0.19	0.79	-0.63	-0.77	-0.66	-0.92	-0.30	-0.01	-0.93	0.22	0.00	-0.04	-0.09	-0.04	0.49	-0.55	0.57	-0.45	-0.08	0.61
HUN	27,671	1,074	-0.48	0.03	0.34	-0.77	-0.13	0.53	0.87	-0.03	-0.52	0.61	-0.75	-0.70	-0.78	-0.72	0.03	-0.20	-0.75	0.18	0.00	-0.07	0.04	0.07	0.88	0.19	-0.01	-0.34	-0.75	-0.33
IND	14,457	10	-0.02	-0.01	0.30	-0.74	0.11	0.32	0.36	-0.31	-0.09	0.03	-0.20	-0.33	-0.05	-0.81	-0.49	0.37	-0.77	-0.11	-0.00	0.03	0.12	-0.14	-0.33	0.07	0.09	-0.61	-0.70	0.94
MEX	16,471	31	-0.30	-0.08	0.36	-0.72	0.83	0.45	-0.52	-0.43	-0.17	0.50	-0.53	-0.55	-0.33	-0.72	-0.01	-0.01	-0.76	0.23	0.00	-0.05	0.13	-0.10	0.60	0.24	0.13	-0.14	0.54	-0.11
SVN	9,343	15	0.62	-0.00	-0.01	0.03	-0.13	0.25	-0.15	-0.78	-0.46	0.16	-0.32	-0.31	0.10	0.08	0.04	-0.08	-0.34	0.16	0.00	-0.04	-0.04	-0.34	0.16	0.08	0.07	-0.45	0.02	-0.30
THA	13,510	171	-0.48	-0.12	0.04	-0.76	1.28	-0.18	1.50	0.41	0.90	-0.59	0.73	1.04	0.52	-0.79	-0.19	-0.04	-0.76	-0.06	-0.00	0.02	0.07	-0.01	-0.12	0.37	-0.09	0.32	-0.08	-0.32
ARG	8,886	23	0.24	-0.03	0.11	0.02	0.24	0.20	-0.23	-0.86	-0.80	0.19	-0.28	-0.42	-0.06	-0.04	0.05	-0.04	-0.12	0.17	-0.00	-0.00	-0.20	0.13	0.05	0.06	0.29	0.03	0.45	0.18
SRB	8,739	25	-0.09	-0.06	0.55	-0.86	0.58	0.83	-0.89	-0.22	0.17	0.73	-0.94	-0.95	-0.82	-0.97	-0.59	0.30	-0.87	-0.72	0.00	-0.06	0.50	-0.46	0.80	-0.79	0.78	-0.47	1.37	-0.66
LTU	8,058	37	-0.27	0.06	-0.00	-0.56	-0.52	0.26	-0.56	-0.75	-0.64	0.37	-0.38	-0.39	-0.17	-0.52	0.13	0.05	-0.56	0.16	0.00	0.01	-0.04	0.16	-0.15	0.29	0.15	-0.44	-0.38	0.93
EST	12,195	82	-0.23	0.03	-0.14	0.68	-0.20	-0.03	-0.06	-0.73	-0.62	-0.07	0.21	-0.01	0.02	0.63	-0.32	0.32	0.42	0.22	0.00	0.02	-0.02	-0.10	-0.26	-0.32	0.42	-0.51	0.69	-0.24
SVK	7,835	160	-0.14	0.02	-0.20	1.41	-0.14	-0.36	-0.49	-0.30	-0.53	0.07	0.59	0.06	0.33	1.30	0.05	0.14	0.93	0.26	0.00	-0.04	-0.01	-0.24	0.14	0.27	-0.12	0.34	0.26	
CYP	5,278	25	1.10	-0.00	0.02	-0.21	-0.28	-0.08	0.14	-0.43	-0.14	-0.10	0.28	0.17	0.29	-0.15	0.31	-0.17	0.10	-0.01	0.01	-0.01	-0.10	0.11	-0.10	0.16	0.14	1.69	-0.26	0.72
SAU	10,191	847	0.34	0.02	-0.01	1.05	-0.26	-0.25	0.36	-0.53	-0.27	-0.32	0.55	0.98	0.58	1.14	0.20	-0.17	0.83	0.24	-0.00	0.04	0.04	0.04	-0.45	0.51	-0.30	0.09	-0.51	0.43
COL	5,372	3	0.60	-0.01	0.38	-0.63	-0.09	0.40	-0.86	-0.22	-0.69	0.60	-0.66	-0.75	-0.46	-0.62	0.17	-0.02	-0.66	0.19	-0.01	-0.04	-0.20	0.08	0.48	0.61	-0.17	0.97	-0.03	0.32

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Table S2: Relative importances of the categories for countries in Biomedical & Health sciences for $\delta = 10$ years

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M$_{all}$	IM$_m$	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	93,959,336	8,188	0.01	0.91	0.57	0.05	0.08	0.06	0.01	0.00	0.00	0.07	0.00	0.00	0.23	0.06	0.02	0.03	0.10	0.06	0.10	0.09	0.03	0.04	0.01	0.00	0.01	0.00	0.00	0.00
USA	33,928,604	7,288	-0.31	0.00	0.07	-0.41	0.03	0.24	-0.48	0.27	0.01	0.19	-0.63	-0.59	-0.53	-0.57	-0.01	0.01	-0.36	-0.28	0.00	-0.01	-0.01	-0.02	0.09	-0.23	0.15	-0.32	-0.07	0.00
GBR	9,921,341	4,090	-0.21	0.02	-0.21	0.46	-0.19	-0.21	0.19	-0.02	0.14	-0.16	0.32	0.29	0.27	0.46	0.09	0.01	0.48	0.07	0.00	0.02	-0.03	0.02	-0.24	0.05	-0.03	-0.03	-0.06	0.13
CHN	10,224,002	945	-0.10	0.03	0.16	-0.36	-0.30	0.24	-0.74	0.48	0.34	0.27	-0.58	-0.58	-0.46	-0.36	0.04	-0.01	-0.35	0.06	0.00	0.03	-0.01	0.04	-0.31	-0.01	-0.01	-0.16	-0.06	-0.10
DEU	9,683,847	5,937	-0.36	0.02	-0.09	-0.30	-0.21	0.03	-0.05	0.24	0.03	0.02	-0.25	-0.19	-0.22	-0.43	-0.02	0.06	-0.25	-0.17	0.00	0.01	-0.06	0.03	-0.08	-0.18	0.13	-0.32	0.02	0.01
JPN	7,392,211	9,663	-0.31	-0.01	0.32	-0.71	0.19	0.46	-0.91	1.23	-0.12	0.38	-0.89	-0.87	-0.88	-0.90	-0.05	0.03	-0.71	-0.63	0.00	-0.04	-0.03	-0.04	0.49	-0.27	0.28	-0.67	0.46	-0.44
ITA	8,219,690	8,873	-0.34	0.00	-0.05	-0.46	0.00	0.10	-0.27	0.25	-0.05	0.12	-0.34	-0.27	-0.31	-0.56	-0.00	-0.05	-0.39	-0.22	0.00	-0.02	0.02	-0.04	0.22	-0.03	0.05	-0.36	0.12	-0.35
CAN	5,521,942	3,822	-0.29	0.01	-0.12	-0.03	-0.02	-0.18	0.66	-0.03	0.26	-0.21	0.43	0.32	0.25	-0.05	-0.15	0.04	0.01	0.02	0.00	0.00	0.01	0.03	-0.02	-0.04	-0.01	-0.39	-0.17	0.02
FRA	7,210,391	5,223	-0.43	0.02	-0.23	-0.16	-0.13	-0.08	0.55	0.25	0.19	-0.18	-0.04	-0.07	-0.12	-0.40	-0.05	0.07	0.01	-0.36	0.00	0.01	-0.03	-0.01	-0.10	-0.13	0.02	-0.46	0.01	-0.11
AUS	3,699,021	3,559	-0.13	0.02	-0.26	0.40	-0.21	-0.31	0.09	0.50	0.49	-0.16	0.36	0.44	0.12	0.41	-0.05	0.12	0.55	-0.02	0.00	0.02	0.00	-0.00	-0.21	-0.06	-0.09	-0.13	-0.24	-0.05
NLD	4,974,288	10,114	-0.35	0.03	0.01	-0.37	-0.26	0.17	-0.40	0.16	0.12	0.16	-0.46	-0.47	-0.22	-0.35	-0.31	0.33	-0.35	0.07	0.00	0.02	0.06	-0.11	-0.19	-0.17	0.16	-0.46	0.10	0.03
ESP	4,703,093	4,115	-0.25	-0.01	-0.10	-0.07	0.11	-0.02	0.61	-0.03	0.04	-0.17	-0.09	-0.05	0.01	-0.25	0.14	-0.04	0.00	-0.19	0.00	-0.04	0.03	0.03	0.14	-0.19	-0.21	0.01	0.01	-0.04
KOR	3,806,842	20,560	-0.14	-0.01	0.36	-0.88	0.09	0.51	-0.88	0.72	-0.21	0.41	-0.91	-0.85	-0.94	-0.97	-0.08	-0.02	-0.87	-0.73	0.00	-0.02	0.07	-0.15	0.28	-0.23	0.22	-0.56	0.06	-0.31
BRA	2,970,780	1,968	-0.12	0.02	0.06	-0.25	-0.16	0.08	-0.67	0.75	0.18	0.16	-0.43	-0.39	-0.51	-0.43	-0.24	0.16	-0.17	-0.26	0.00	-0.01	0.01	-0.06	0.10	-0.11	0.09	-0.34	0.17	-0.23
SWE	2,549,442	5,081	0.40	0.01	-0.20	0.87	-0.14	-0.28	1.20	-0.18	-0.03	-0.39	1.15	1.05	0.71	1.15	0.01	0.11	0.84	0.27	-0.00	-0.04	-0.02	0.03	-0.46	-0.02	-0.11	-0.13	0.30	0.04
CHE	2,648,795	3,385	-0.25	0.01	-0.04	-0.11	-0.02	0.01	-0.08	-0.18	-0.17	0.00	-0.16	-0.15	0.13	-0.07	-0.10	0.05	-0.12	0.14	0.00	-0.01	0.01	0.01	0.13	-0.07	0.10	-0.13	0.30	-0.15
TUR	1,436,652	4,239	0.07	-0.05	0.47	-0.91	0.53	0.55	-0.92	0.44	-0.30	0.44	-0.94	-0.93	-0.89	-0.97	0.01	-0.04	-0.91	-0.65	0.00	-0.06	-0.04	-0.03	0.75	-0.26	0.27	-0.51	0.52	-0.57
TWN	1,453,522	1,626	-0.15	0.03	0.12	-0.37	-0.27	0.24	-0.77	0.92	0.01	0.23	-0.71	-0.62	-0.70	-0.63	0.02	0.02	-0.31	-0.42	0.00	-0.03	0.02	-0.06	-0.05	-0.02	-0.38	0.07	-0.21
DNK	1,725,540	4,128	-0.26	0.02	-0.30	0.37	-0.13	-0.37	0.18	0.56	-0.07	-0.24	0.47	0.69	-0.16	-0.40	0.16	-0.05	0.69	-0.61	0.00	0.00	-0.10	0.05	-0.06	0.00	-0.09	-0.22	-0.36	0.08
BEL	1,942,386	2,476	-0.25	-0.00	-0.03	-0.19	0.05	0.01	1.26	-0.28	-0.04	-0.27	0.34	0.15	0.45	-0.17	0.02	0.06	-0.25	0.19	0.00	0.02	-0.00	0.03	-0.28	-0.03	0.04	-0.16	0.14	0.06
POL	1,373,790	2,653	-0.15	-0.03	0.12	-0.65	0.30	0.12	0.95	-0.18	0.06	-0.14	-0.11	-0.18	-0.01	-0.67	0.04	0.01	-0.65	0.02	-0.00	-0.04	0.03	0.16	0.04	0.02	0.16	0.16	0.06	
IND	747,969	1,625	0.23	-0.01	0.45	-0.77	0.06	0.47	-0.85	0.13	0.28	0.38	-0.86	-0.85	-0.73	-0.77	-0.04	0.02	-0.79	0.18	-0.00	-0.04	-0.04	0.04	0.43	0.10	0.13	0.51	-0.04	0.53
AUT	1,675,734	4,776	-0.30	0.01	0.00	-0.06	-0.04	0.06	0.04	-0.21	-0.03	-0.01	-0.21	-0.26	0.08	-0.01	-0.12	0.09	-0.08	0.16	0.00	0.00	0.00	-0.06	0.09	0.06	-0.27	-0.04	0.18	
ISR	1,130,866	2,291	-0.26	0.02	-0.10	-0.25	-0.15	-0.06	0.85	0.05	0.71	-0.19	-0.10	0.11	0.39	-0.21	0.34	-0.41	-0.19	0.05	0.00	0.03	0.17	-0.15	-0.31	0.07	-0.23	-0.40	-0.10	0.20
GRC	1,098,046	23,721	-0.34	0.02	0.38	-0.61	-0.17	0.39	-0.65	-0.13	-0.11	0.27	-0.82	-0.83	-0.63	-0.61	-0.17	0.19	-0.61	0.09	0.00	-0.01	0.04	-0.06	0.09	-0.04	0.17	-0.42	0.23	-0.16
NOR	1,088,074	2,636	-0.23	0.02	-0.08	-0.12	-0.13	-0.10	0.29	0.01	0.23	-0.07	0.11	0.27	0.18	-0.11	0.22	-0.10	-0.11	0.08	0.00	-0.06	0.06	-0.15	0.22	-0.12	-0.19	-0.10	0.18	
IRN	496,041	2,020	0.03	0.02	0.09	-0.05	-0.20	-0.02	-0.04	-0.25	0.19	0.01	-0.06	-0.04	-0.12	-0.01	0.13	-0.05	-0.06	0.14	-0.00	0.02	0.05	-0.04	-0.20	-0.12	-0.07	0.33	-0.35	-0.28
FIN	1,182,799	5,556	-0.20	0.01	-0.28	0.39	-0.07	-0.41	0.39	0.49	-0.01	-0.24	0.83	1.00	0.24	0.60	0.06	0.02	0.56	0.11	-0.00	0.00	0.03	-0.04	-0.10	-0.09	-0.20	0.05	-0.44	-0.03
IRL	773,394	1,736	0.09	0.01	0.01	-0.26	-0.09	-0.03	0.26	0.04	0.23	-0.04	-0.01	-0.01	-0.14	-0.31	-0.26	0.27	-0.25	-0.01	0.00	0.01	0.06	-0.09	-0.06	-0.33	0.15	-0.12	-0.25	-0.05
PRT	720,738	1,702	0.01	-0.01	0.12	-0.51	0.14	0.22	-0.52	0.04	-0.62	0.22	-0.50	-0.44	-0.40	-0.61	0.06	-0.02	-0.51	-0.15	-0.00	-0.03	-0.03	0.01	0.40	0.07	0.09	-0.15	0.20	0.04
CZE	896,872	2,515	-0.21	-0.00	-0.05	-0.44	0.05	0.02	-0.04	-0.19	-0.28	0.04	-0.07	-0.01	-0.12	-0.63	-0.07	0.02	-0.40	-0.34	0.00	-0.03	0.01	-0.04	0.38	0.28	-0.03	-0.33	0.04	0.08
RUS	484,802	893	0.27	-0.01	0.10	-0.07	0.08	0.20	-0.34	-0.47	-0.08	0.17	-0.41	-0.40	-0.03	0.10	-0.30	0.04	-0.09	0.05	-0.10	0.20	-0.04	-0.04	0.34	-0.25	0.06			
SGP	620,466	8,460	-0.20	0.05	-0.32	1.98	-0.48	-0.54	0.07	-0.10	-0.23	-0.32	1.09	1.43	0.87	2.43	0.21	-0.07	1.91	0.27	0.00	0.05	0.11	-0.04	-0.59	0.14	-0.18	-0.19	-0.27	0.09
ZAF	453,672	2,811	0.45	0.02	-0.21	1.41	-0.22	-0.26	-0.54	-0.50	-0.40	-0.12	0.60	0.45	0.67	1.64	0.12	0.01	1.27	-0.26	-0.00	0.04	-0.05	0.06	-0.46	0.12	-0.02	0.54	-0.12	0.49
NZL	417,422	1,584	0.35	-0.00	-0.10	0.08	0.00	-0.20	0.99	-0.09	0.20	-0.25	0.58	0.67	0.48	0.21	-0.03	-0.05	0.10	0.19	-0.00	0.02	0.05	-0.00	-0.28	-0.11	-0.21	0.27	-0.27	0.18
HUN	653,117	4,772	-0.24	-0.04	0.11	-0.20	0.41	-0.02	1.91	-0.27	-0.05	-0.46	0.58	0.39	0.50	-0.17	-0.02	-0.02	-0.24	0.17	0.00	0.00	-0.00	0.02	-0.02	-0.01	-0.13	-0.01	-0.29	-0.13
THA	431,396	13,049	0.06	0.02	-0.30	2.58	-0.20	-0.56	-0.26	-0.76	-0.77	-0.26	1.42	1.22	0.88	2.68	0.22	-0.01	2.06	0.30	-0.00	-0.03	-0.09	0.04	-0.34	0.26	0.04	0.19	0.05	0.38
EGY	318,860	380	0.84	-0.02	-0.21	1.23	0.08	-0.42	0.01	-0.13	0.62	-0.28	0.54	0.60	0.59	1.63	-0.01	-0.16	1.34	0.22	-0.00	0.01	0.04	0.03	0.03	-0.17	1.24	-0.53	-0.21	
MEX	238,621	186	0.31	-0.01	0.06	-0.23	0.09	-0.09	-0.36	-0.08	0.18	0.12	0.10	0.08	-0.08	-0.25	-0.02	-0.00	-0.26	0.09	-0.00	-0.02	-0.07	0.06	0.24	0.03	0.07	0.35	0.05	0.31
MYS	197,485	588	0.70	0.00	0.06	-0.15	-0.09	-0.02	-0.37	0.07	0.18	0.15	0.00	-0.07	-0.02	-0.11	0.01	-0.13	-0.23	0.25	-0.00	0.01	0.05	-0.00	-0.16	0.08	0.01	0.51	0.01	0.44
SAU	322,965	1,496	0.16	-0.02	0.05	0.26	0.24	0.04	-0.64	-0.27	0.18	0.12	-0.36	-0.35	0.10	0.41	-0.12	-0.15	0.23	0.24	-0.00	-0.02	-0.01	0.03	0.20	0.08	-0.06	0.05	-0.20	0.01
CHL	288,859	1,069	0.02	-0.01	-0.11	0.86	0.06	-0.18	-0.42	-0.23	0.02	-0.03	0.09	0.07	0.29	1.10	0.04	0.08	0.90	0.19	-0.00	0.01	0.10	-0.06	-0.10	-0.16	0.00	-0.06	-0.03	-0.25
ROU	234,054	1,034	0.34	-0.04	0.19	-0.78	0.38	0.39	-0.39	-0.52	-0.57	0.27	-0.66	-0.62	-0.39	-0.80	0.00	-0.09	-0.78	0.01	-0.00	-0.01	0.03	0.02	0.09	0.11	-0.07	0.07	0.00	0.04
ARG	195,311	181	0.63	-0.04	0.20	-0.62	0.34	0.21	-0.74	-0.25	-0.02	0.32	-0.32	-0.40	-0.30	-0.65	0.06	-0.04	-0.63	0.04	-0.00	-0.04	0.01	-0.08	0.50	0.02	0.16	0.85	0.26	0.07
SRB	196,159	969	0.08	-0.03	0.18	-0.82	0.29	0.21	-0.78	0.06	0.68	0.38	-0.28	-0.35	-0.33	-0.86	-0.04	-0.03	-0.83	-0.08	0.00	-0.04	-0.15	0.11	0.48	0.22	0.03	-0.27	0.19	0.07
HRV	208,904	858	0.17	-0.02	0.02	0.03	0.20	0.05	-0.01	-0.25	-0.26	-0.00	-0.23	-0.25	0.06	-0.00	0.13	-0.11	0.13	-0.04	0.00	0.00	-0.05	0.05	-0.00	0.01	-0.23	-0.04	-0.27	-0.23
SVN	165,229	619	0.18	-0.03	0.07	-0.61	0.28	0.14	1.20	-0.76	-0.59	-0.21	0.31	0.32	-0.63	-0.05	0.02	-0.62	0.07	0.00	0.01	0.02	-0.01	0.06	-0.04	0.11	-0.03	0.28	-0.08	
PAK	124,525	1,621	-0.19	0.04	-0.17	1.05	-0.36	-0.28	0.99	0.21	0.75	-0.35	0.52	0.41	0.57	1.21	-0.17	0.18	0.87	0.27	0.00	0.05	0.16	-0.10	-0.58	-0.12	-0.01	-0.34	0.28	-0.14
SVK	163,795	1,453	0.65	-0.01	-0.20	1.66	0.02	-0.40	-0.35	-0.63	-0.67	-0.09	0.97	0.68	0.57	1.70	0.11	0.05	1.29	0.28	-0.00	0.02	-0.06	0.02	-0.18	0.18	0.06	1.07	-0.02	0.46
LTU	91,789	244	0.12	-0.02	0.05	-0.63	0.16	0.06	0.31	-0.82	-0.76	0.01	0.16	0.23	0.18	-0.58	0.10	-0.27	-0.63	0.24	-0.00	-0.05	0.08	0.06	0.53	0.52	-0.16	0.72	0.19	0.22
NGA	54,844	179	0.42	-0.01	-0.06	-0.21	0.06	-0.20	0.01	-0.06	0.12	0.00	0.44	0.34	0.31	-0.13	-0.07	-0.05	-0.22	0.20	-0.00	-0.02	-0.06	0.10	0.20	0.20	-0.15	0.47	0.50	-0.35

Table S3: Relative importances of the categories for countries in Physical sciences & Engineering for $\delta = 10$ years

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M$_{all}$	IM$_m$	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	35,167,505	2,331	0.01	0.92	0.49	0.09	0.07	0.03	0.01	0.00	0.00	0.04	0.01	0.01	0.48	0.15	0.05	0.07	0.18	0.15	0.18	0.16	0.06	0.07	0.01	0.00	0.01	0.00	0.00	0.00
CHN	10,363,608	1,371	-0.17	0.05	0.35	-0.51	-0.46	0.62	-0.77	0.25	-0.11	0.41	-0.73	-0.70	-0.66	-0.58	0.06	-0.03	-0.50	-0.15	0.00	0.02	-0.02	0.06	-0.24	0.00	0.13	-0.35	0.31	-0.21
USA	8,586,374	2,077	-0.44	0.01	-0.08	-0.12	-0.06	-0.03	0.21	0.22	0.22	-0.10	-0.10	-0.02	-0.09	-0.12	-0.03	0.05	-0.07	-0.03	0.00	-0.00	-0.01	0.02	0.02	0.04	-0.03	-0.37	0.09	-0.07
DEU	4,283,016	2,722	-0.38	0.03	-0.06	0.19	-0.21	-0.00	0.18	-0.16	-0.04	-0.11	0.02	-0.05	0.05	0.20	0.07	0.06	0.19	0.04	0.00	0.02	-0.00	0.01	-0.27	-0.01	0.05	-0.27	0.22	-0.12
JPN	2,968,967	2,711	-0.08	0.02	-0.03	-0.19	-0.16	0.27	-0.61	0.83	-0.15	0.26	-0.49	-0.45	-0.41	-0.34	0.00	0.11	-0.14	-0.21	-0.00	0.00	0.05	-0.09	-0.02	-0.09	0.22	0.08	0.22	-0.14
GBR	3,088,381	2,506	-0.43	-0.02	-0.01	0.08	0.28	-0.09	0.51	-0.11	0.06	-0.25	0.21	0.23	0.21	0.11	-0.02	0.03	0.06	0.07	0.00	-0.02	-0.01	-0.00	0.31	0.11	0.03	-0.35	0.03	0.14
FRA	3,379,047	1,323	-0.43	-0.01	-0.01	-0.23	0.22	0.03	0.74	-0.10	-0.07	-0.24	0.19	0.16	0.09	-0.26	-0.02	0.07	-0.20	-0.06	0.00	-0.01	-0.00	-0.01	0.09	-0.08	-0.07	-0.33	-0.02	-0.18
KOR	1,852,837	1,158	0.04	0.04	-0.07	0.12	-0.46	-0.02	-0.34	0.40	0.07	0.09	-0.21	-0.15	-0.24	0.09	0.09	-0.00	0.19	-0.06	-0.00	0.03	0.09	-0.09	-0.46	-0.08	0.04	0.46	-0.11	0.08
IND	967,436	1,363	0.28	0.01	0.15	-0.54	-0.18	-0.01	-0.58	0.52	0.51	0.39	-0.08	-0.14	-0.25	-0.53	-0.33	0.11	-0.53	0.03	0.00	0.01	0.12	-0.12	-0.12	-0.26	0.19	-0.41	0.46	-0.28
ITA	2,342,357	1,900	-0.41	-0.02	-0.08	0.14	0.24	-0.07	-0.00	-0.12	-0.08	-0.07	-0.01	0.04	0.06	0.13	0.04	-0.05	0.15	0.00	0.00	-0.02	0.03	-0.02	0.32	0.21	-0.05	-0.37	0.15	-0.30
ESP	1,852,018	1,416	0.01	-0.00	-0.05	-0.35	0.02	0.16	-0.28	0.25	0.11	0.17	-0.27	-0.26	-0.16	-0.36	-0.04	0.08	-0.31	-0.04	0.00	-0.02	0.00	-0.03	0.20	-0.03	0.02	-0.19	0.12	-0.17
RUS	1,529,642	1,890	-0.02	0.01	0.12	0.09	-0.06	0.20	-0.49	0.02	-0.05	0.22	-0.32	-0.32	-0.19	0.07	0.17	-0.01	0.04	0.05	-0.00	0.01	0.01	-0.03	-0.14	0.13	0.01	0.55	0.07	0.10
CAN	1,156,385	1,126	-0.36	-0.03	0.14	-0.15	0.43	0.19	1.47	-0.29	-0.10	-0.52	0.37	0.20	0.27	-0.15	-0.09	0.06	-0.18	0.07	0.00	0.00	0.00	0.01	-0.01	-0.12	-0.09	-0.20	-0.15	0.11
AUS	1,055,964	1,970	-0.33	0.00	-0.01	-0.12	0.01	0.12	1.00	-0.22	-0.08	-0.34	0.17	0.15	0.13	-0.14	-0.02	0.03	-0.14	0.02	0.00	0.02	0.06	-0.03	-0.22	-0.08	0.00	-0.43	-0.03	-0.13
IRN	345,946	1,833	0.85	-0.02	0.35	-0.63	0.06	0.82	-0.84	0.22	0.23	0.52	-0.83	-0.81	-0.71	-0.72	-0.21	-0.10	-0.60	-0.28	0.00	-0.01	-0.04	-0.03	0.07	-0.22	0.16	-0.11	0.27	-0.57
TWN	818,100	652	-0.28	0.03	-0.04	-0.29	-0.31	0.03	0.30	-0.08	-0.24	-0.13	-0.12	-0.04	-0.39	-0.44	-0.07	0.02	-0.17	-0.31	0.00	0.01	0.02	-0.06	-0.19	-0.18	-0.06	-0.23	-0.23	-0.24
BRA	812,346	805	-0.01	0.01	-0.08	-0.28	-0.13	-0.05	-0.37	0.64	0.10	0.14	-0.18	-0.08	-0.42	-0.51	-0.05	0.06	-0.21	-0.36	-0.00	-0.01	-0.02	0.01	0.16	0.12	0.02	-0.10	0.19	-0.09
POL	846,089	3,225	-0.28	-0.05	-0.12	0.74	0.61	-0.27	-0.54	-0.43	-0.40	-0.05	0.02	0.14	0.17	0.76	0.10	-0.14	0.62	0.12	0.00	-0.07	-0.07	0.06	0.95	0.31	0.09	-0.20	0.24	0.10
CHE	1,028,878	2,277	-0.47	-0.01	-0.07	-0.14	0.14	-0.13	0.23	0.14	0.21	-0.04	0.26	0.08	0.13	-0.14	-0.16	0.23	-0.18	0.08	0.00	-0.01	0.04	-0.10	0.10	-0.26	0.09	-0.53	0.13	-0.16
NLD	953,715	2,936	-0.41	0.01	0.00	0.59	-0.06	0.02	0.96	-0.31	-0.13	-0.40	0.41	0.28	0.31	0.57	0.01	0.08	0.45	0.11	0.00	0.03	0.02	0.03	-0.40	-0.01	-0.04	-0.36	0.08	0.12
TUR	308,101	1,248	0.15	0.03	-0.09	0.35	-0.33	-0.09	-0.13	0.07	-0.02	0.04	-0.06	0.12	0.05	0.40	0.12	-0.11	0.33	0.08	0.00	0.04	0.07	0.04	-0.48	-0.23	-0.09	-0.06	-0.03	0.22
SWE	752,009	1,366	-0.13	0.02	-0.05	0.44	-0.18	-0.11	0.06	-0.38	-0.32	-0.08	0.19	0.19	0.21	0.47	0.09	0.03	0.37	0.10	-0.00	0.02	0.00	0.01	-0.29	0.04	0.01	0.15	-0.06	0.31
BEL	742,621	2,318	-0.47	-0.00	0.01	-0.25	0.12	-0.06	0.46	0.00	0.11	-0.09	0.26	0.15	0.07	-0.28	-0.08	0.15	-0.28	0.03	0.00	0.00	-0.04	-0.05	-0.11	-0.01	-0.51	-0.03	0.02	
SGP	459,453	1,410	-0.22	0.05	-0.01	0.30	-0.48	0.01	-0.73	-0.43	-0.19	0.17	-0.27	-0.25	-0.05	0.33	-0.04	0.06	0.25	0.09	0.00	0.03	-0.01	0.07	0.39	0.07	0.11	-0.35	0.15	-0.04
PRT	473,214	2,301	-0.24	0.01	-0.03	-0.24	-0.01	-0.01	0.19	0.08	-0.14	0.08	-0.05	-0.08	-0.10	-0.24	-0.10	0.14	-0.22	-0.01	0.00	-0.02	0.00	-0.03	0.22	-0.13	0.12	-0.07	-0.09	-0.04
CZE	503,947	2,191	-0.12	-0.00	-0.00	-0.27	0.05	-0.01	-0.56	0.08	0.34	0.22	-0.19	-0.06	-0.25	-0.39	0.20	-0.10	-0.21	-0.20	0.00	-0.03	-0.11	0.05	0.41	0.82	-0.24	-0.36	0.12	0.19
AUT	472,246	1,030	-0.30	-0.04	-0.04	-0.10	0.07	-0.05	0.22	0.08	0.29	-0.12	0.02	-0.10	0.05	-0.10	0.01	-0.00	-0.10	0.02	0.00	-0.02	-0.04	0.01	0.27	0.16	-0.08	-0.30	0.00	-0.19
MYS	210,191	15,151	0.10	0.07	-0.03	0.13	-0.72	0.10	-0.33	-0.52	-0.37	0.19	-0.20	-0.20	0.13	0.22	-0.27	0.04	0.10	0.14	0.00	0.06	0.46	-0.26	-0.80	-0.19	0.06	-0.29	0.60	-0.21
ROU	301,946	900	-0.11	-0.00	-0.04	-0.35	0.02	0.20	-0.60	0.62	0.19	0.32	-0.33	-0.32	-0.32	-0.35	0.14	-0.11	-0.31	-0.04	-0.00	-0.01	-0.06	0.12	0.13	0.17	-0.01	0.12	0.02	-0.02
DNK	456,882	2,616	-0.55	-0.02	-0.01	-0.32	0.30	-0.24	0.95	0.22	0.71	-0.32	0.26	0.54	0.05	-0.31	-0.03	-0.08	-0.31	0.03	0.00	-0.02	0.10	-0.08	0.25	0.00	-0.21	-0.62	-0.22	-0.19
ISR	311,563	901	-0.22	-0.01	0.02	-0.13	0.16	-0.18	0.31	0.17	0.31	-0.11	0.28	0.18	0.15	-0.11	-0.02	0.08	-0.12	0.04	0.00	-0.01	-0.02	-0.02	0.16	-0.02	-0.04	0.10	0.20	0.04
FIN	415,659	2,021	-0.33	-0.01	-0.00	-0.07	0.20	0.25	-0.51	-0.19	-0.22	0.20	-0.42	-0.37	-0.08	-0.04	0.07	-0.03	-0.09	0.07	0.00	-0.03	0.01	-0.01	0.38	0.02	0.17	-0.14	0.12	0.12
UKR	309,094	1,023	0.13	-0.02	-0.09	0.05	0.16	-0.22	-0.22	-0.23	-0.23	0.11	0.32	0.22	0.14	0.10	0.01	0.03	0.03	0.11	-0.00	-0.00	0.04	-0.03	0.05	0.04	0.05	0.61	0.12	0.13
GRC	290,229	960	0.21	0.01	-0.11	0.24	-0.10	-0.20	-0.23	0.40	0.12	0.01	0.08	0.06	0.06	0.24	0.08	-0.01	0.20	0.07	0.00	0.00	-0.05	0.04	-0.04	0.11	0.02	0.86	0.12	0.20
MEX	225,948	367	0.37	0.00	0.06	-0.14	0.07	-0.11	-0.43	-0.24	-0.14	0.02	0.23	0.21	0.11	-0.18	-0.02	0.04	-0.17	0.01	-0.00	0.00	-0.08	0.04	-0.09	-0.02	0.05	0.50	-0.27	0.56
SAU	280,647	8,438	0.73	0.04	-0.15	0.86	-0.56	-0.22	-0.03	-0.49	0.11	-0.12	0.01	0.25	0.33	1.09	0.01	-0.24	0.91	0.12	-0.00	0.05	0.02	0.04	-0.67	-0.01	-0.23	0.20	-0.10	0.21
EGY	129,202	1,659	0.76	-0.01	-0.10	0.75	-0.06	-0.33	-0.27	-0.56	0.08	-0.29	0.38	0.55	0.39	0.98	0.02	-0.21	0.88	0.09	-0.00	0.02	0.02	-0.02	-0.22	-0.07	-0.23	0.86	-0.53	-0.18
ZAF	198,602	1,974	0.54	-0.00	0.12	0.04	-0.05	0.26	-0.28	-0.25	0.02	0.14	-0.46	-0.37	-0.04	0.13	-0.14	-0.16	0.05	0.11	0.00	0.01	-0.09	0.04	-0.17	0.06	0.03	-0.19	-0.24	0.39
HUN	254,035	1,709	0.09	-0.02	-0.03	0.36	0.17	-0.21	0.08	-0.36	-0.32	-0.03	0.39	0.38	0.27	0.33	0.21	-0.05	0.25	0.10	-0.00	-0.01	-0.08	0.05	-0.09	0.03	-0.08	0.64	-0.16	0.47
NOR	180,363	527	-0.04	-0.00	-0.09	0.02	0.01	-0.06	-0.39	-0.17	-0.09	0.14	-0.07	0.01	0.04	0.04	0.08	-0.06	-0.01	0.08	-0.00	-0.01	0.01	-0.01	0.09	-0.00	0.06	0.30	0.21	0.01
IRL	211,526	620	-0.09	0.01	0.03	-0.13	-0.11	0.15	-0.59	-0.29	-0.09	0.21	-0.29	-0.38	-0.11	-0.10	-0.30	0.24	-0.13	0.07	0.00	-0.01	0.07	-0.07	0.16	-0.29	0.24	-0.29	0.31	-0.02
THA	121,672	1,429	1.99	-0.02	0.05	-0.50	-0.12	-0.39	-0.42	1.64	-0.58	0.10	0.24	0.19	-0.15	0.84	0.03	-0.12	-0.44	-0.70	0.00	-0.07	-0.32	0.14	0.96	-0.75	0.62	-0.23	-0.67	-0.29
SRB	125,438	659	0.01	-0.01	0.27	-0.64	0.06	0.54	-0.76	0.48	-0.16	0.50	-0.55	-0.53	-0.46	-0.66	0.10	-0.03	-0.66	0.03	-0.00	-0.01	-0.02	0.01	0.20	0.29	0.08	0.21	0.25	0.07
ARG	109,746	255	0.32	-0.01	-0.01	-0.20	0.05	-0.07	-0.26	-0.12	0.07	0.00	0.17	-0.01	0.11	-0.19	0.03	-0.01	-0.22	0.07	-0.00	-0.01	-0.10	0.09	-0.11	-0.02	0.04	1.10	-0.16	0.01
CHL	209,565	5,357	-0.27	-0.06	-0.10	1.11	0.64	-0.32	-0.36	-0.66	-0.49	-0.15	0.24	0.24	0.33	1.08	0.08	-0.10	0.88	0.13	0.00	-0.06	-0.06	0.07	0.77	0.28	0.13	-0.14	-0.01	0.39
SVN	136,800	2,176	-0.50	-0.09	0.34	-0.60	1.07	0.50	2.21	-0.42	-0.19	-0.72	0.46	0.18	0.38	-0.64	0.03	0.07	-0.64	0.03	0.00	0.00	-0.01	0.00	-0.05	0.03	-0.19	-0.31	-0.40	-0.29
PAK	90,020	9,881	1.37	0.04	-0.22	1.28	-0.67	-0.43	0.20	-0.18	0.59	-0.31	0.37	0.49	1.56	0.02	-0.21		1.41	0.10	-0.00	0.06	0.20	-0.09	-0.76	-0.40	-0.25	0.58	-0.16	0.22
SVK	145,580	790	-0.19	-0.03	-0.04	-0.50	0.36	0.02	-0.18	-0.62	-0.62	0.23	0.19	0.06	0.07	-0.52	-0.04	0.07	-0.51	0.01	0.00	-0.02	-0.04	0.02	0.25	0.13	0.06	-0.01	0.02	0.13
DZA	81,577	810	0.19	0.04	-0.10	0.08	-0.09	-0.31	0.83	0.81	0.76	-0.37	0.39	0.04	0.16	0.19	-0.01	0.17	0.29	-0.05	-0.00	0.02	-0.25	0.22	-0.28	-0.16	-0.49	0.85	-0.82	-0.38
NZL	94,194	369	-0.08	0.00	0.04	0.02	-0.02	-0.13	0.51	-0.16	0.33	-0.23	0.09	0.31	0.16	0.10	-0.04	-0.16	0.02	0.10	0.00	0.00	0.06	-0.05	-0.02	0.05	-0.19	-0.34	-0.11	0.15
BGR	96,685	361	0.18	-0.01	-0.04	0.01	0.07	-0.07	-0.23	-0.06	0.10	0.10	0.02	0.02	0.06	0.05	0.21	-0.08	0.01	0.07	-0.00	-0.00	-0.02	0.05	0.02	0.13	-0.19	0.82	-0.20	0.01

Table S4: Relative importances of the categories for countries in Life & Earth sciences for $\delta = 10$ years

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	22,557,784	704	0.01	0.92	0.47	0.10	0.07	0.04	0.01	0.00	0.00	0.05	0.01	0.01	0.47	0.16	0.05	0.07	0.20	0.16	0.20	0.18	0.07	0.07	0.01	0.00	0.01	0.00	0.00	0.00
USA	6,996,167	539	-0.27	0.01	-0.12	0.09	-0.11	-0.09	0.07	0.39	0.02	-0.07	-0.08	-0.03	-0.06	0.07	-0.11	0.09	0.19	-0.07	0.00	0.01	0.05	-0.04	-0.11	-0.15	0.01	-0.28	0.17	-0.14
CHN	4,149,832	550	-0.20	0.04	0.14	0.12	-0.44	0.17	-0.41	0.01	0.06	0.09	-0.40	-0.37	-0.07	0.16	0.15	-0.10	0.12	0.07	0.00	0.04	-0.01	0.02	-0.51	0.07	-0.09	-0.32	-0.04	0.19
GBR	2,397,358	772	-0.26	0.02	-0.23	1.31	-0.15	-0.43	0.23	-0.39	-0.37	-0.26	0.79	0.70	0.51	1.30	0.17	-0.02	1.08	0.14	0.00	0.02	-0.05	0.02	-0.25	0.20	0.02	-0.03	0.03	0.25
DEU	2,334,606	438	-0.36	0.02	-0.17	-0.15	-0.19	-0.13	0.28	0.11	0.13	-0.07	0.16	0.12	0.11	-0.11	-0.16	0.17	-0.10	0.01	0.00	0.01	0.04	-0.05	-0.12	-0.22	0.08	-0.44	0.12	-0.19
BRA	1,535,282	529	-0.15	0.00	0.10	-0.23	0.02	0.16	-0.47	0.93	-0.08	0.10	-0.47	-0.37	-0.61	-0.55	0.06	-0.07	-0.19	-0.42	0.00	-0.02	-0.02	0.01	0.25	-0.20	0.17	-0.18	0.02	-0.03
FRA	2,016,547	409	-0.20	0.02	-0.11	0.23	-0.22	-0.12	0.07	-0.15	-0.07	-0.10	0.07	0.03	0.11	0.28	-0.06	0.12	0.27	0.04	0.00	0.01	0.08	-0.08	-0.19	-0.06	0.01	-0.02	0.16	-0.10
CAN	1,202,791	752	-0.42	0.05	-0.05	0.70	-0.55	-0.19	0.32	0.07	-0.08	-0.12	0.24	0.28	0.45	0.76	0.22	-0.05	0.63	0.12	0.00	0.05	-0.01	0.02	-0.68	0.06	-0.03	-0.42	-0.22	0.35
ESP	1,426,076	784	-0.01	-0.02	0.05	-0.38	0.25	0.32	-0.58	0.38	-0.16	0.18	-0.52	-0.51	-0.32	-0.38	-0.07	0.06	-0.33	-0.05	0.00	-0.03	-0.04	0.04	0.39	-0.06	0.05	-0.17	0.27	-0.28
JPN	1,334,389	471	-0.03	-0.01	0.06	-0.34	0.12	0.23	-0.41	0.71	0.08	0.13	-0.48	-0.44	-0.44	-0.48	-0.26	0.20	-0.29	-0.24	0.00	-0.02	0.04	-0.12	0.28	-0.29	0.19	-0.25	0.01	-0.44
ITA	1,456,927	466	0.17	-0.01	-0.00	-0.37	0.14	0.22	-0.37	0.43	-0.10	0.15	-0.43	-0.33	-0.31	-0.33	-0.15	0.12	-0.29	-0.02	-0.00	-0.01	0.09	-0.07	0.11	-0.13	0.09	0.18	0.48	-0.28
AUS	998,525	512	-0.08	0.02	-0.14	0.15	-0.22	-0.24	0.27	0.04	0.35	-0.12	0.24	0.27	0.21	0.21	-0.06	0.02	0.19	0.05	0.00	0.01	0.02	0.00	-0.20	-0.12	-0.01	-0.28	-0.06	-0.03
KOR	792,561	334	-0.01	0.02	0.10	-0.32	-0.23	0.14	-0.27	0.53	0.14	0.07	-0.41	-0.28	-0.54	-0.55	-0.06	0.03	-0.26	-0.37	0.00	0.00	0.03	-0.02	-0.07	-0.25	0.11	-0.07	-0.14	-0.35
NLD	934,686	587	-0.26	0.04	-0.11	0.11	-0.41	-0.06	0.40	-0.20	-0.20	-0.11	0.11	0.05	0.28	0.19	-0.16	0.21	0.12	0.09	0.00	0.03	-0.03	0.04	-0.46	-0.04	-0.04	-0.31	-0.08	0.01
IND	355,780	252	0.24	-0.04	0.35	-0.55	0.40	0.30	-0.48	-0.32	0.14	0.24	-0.41	-0.44	-0.33	-0.56	-0.17	0.04	-0.56	0.07	0.00	-0.02	0.03	-0.01	0.30	-0.19	0.15	0.32	0.09	0.00
CHE	736,891	396	-0.30	0.02	-0.16	-0.07	-0.22	-0.12	0.53	-0.11	-0.07	-0.13	0.19	0.22	0.24	0.01	-0.05	0.02	-0.03	0.07	0.00	0.01	0.02	-0.00	-0.18	-0.07	-0.03	-0.34	0.08	-0.06
POL	377,023	220	0.32	-0.04	0.02	-0.52	0.40	0.06	-0.25	0.86	0.41	0.14	-0.17	-0.11	-0.39	-0.54	0.00	-0.05	-0.46	-0.11	-0.00	-0.04	0.02	0.01	0.53	-0.07	-0.14	0.09	-0.13	-0.04
SWE	634,280	184	-0.28	0.01	-0.11	0.13	-0.04	-0.23	1.45	-0.31	-0.06	-0.32	0.69	0.57	0.46	0.16	-0.04	0.03	0.15	0.04	0.00	0.02	-0.02	0.02	-0.23	-0.07	-0.09	-0.20	-0.14	0.01
TUR	272,943	229	0.28	-0.02	-0.14	0.17	0.13	-0.11	0.37	0.15	-0.25	-0.03	0.23	0.19	-0.12	-0.20	-0.32	0.41	-0.08	-0.10	-0.00	0.01	0.11	-0.20	-0.09	-0.43	0.29	0.18	0.64	-0.48
BEL	563,777	841	-0.20	0.02	0.06	-0.22	-0.16	0.16	-0.28	0.04	-0.32	0.09	-0.30	-0.26	-0.16	-0.21	0.12	-0.01	-0.24	-0.08	0.00	-0.02	-0.01	-0.09	0.13	0.05	0.08	0.06	0.31
RUS	338,810	412	0.07	-0.02	0.15	-0.18	0.26	0.16	-0.29	-0.19	0.05	0.15	-0.21	-0.21	-0.20	-0.18	0.12	-0.09	-0.18	0.03	-0.00	0.00	-0.09	0.09	-0.05	0.23	-0.24	0.49	-0.30	-0.08
IRN	189,304	298	0.39	0.01	0.14	-0.13	-0.14	0.15	0.24	-0.30	0.02	0.01	-0.18	-0.23	-0.05	-0.14	-0.20	0.20	-0.12	0.01	-0.00	0.02	-0.12	0.13	-0.32	-0.12	0.03	0.29	-0.30	0.65
DNK	488,052	340	-0.28	0.02	-0.16	0.03	-0.14	-0.20	0.58	-0.25	0.08	-0.15	0.38	0.39	0.29	0.03	0.05	-0.02	0.02	0.04	0.00	0.01	0.03	-0.03	-0.13	0.08	-0.05	-0.34	-0.06	-0.02
TWN	322,576	169	-0.26	0.03	-0.07	-0.13	-0.30	-0.10	-0.03	0.27	0.48	-0.03	0.00	0.01	-0.17	-0.19	-0.02	-0.03	-0.06	-0.11	0.00	0.01	0.03	-0.01	-0.17	-0.10	-0.04	-0.30	-0.13	0.06
PRT	403,225	894	0.02	0.00	-0.04	-0.22	-0.05	-0.09	-0.43	0.34	0.05	0.04	-0.02	-0.04	-0.16	-0.19	0.16	-0.15	-0.20	0.04	-0.00	-0.03	-0.10	0.11	0.42	0.15	0.01	0.30	0.25	-0.43
ZAF	277,071	734	0.25	0.02	0.03	-0.13	-0.25	0.04	-0.15	-0.09	0.07	0.02	-0.16	-0.18	-0.01	-0.08	-0.00	-0.06	-0.09	0.05	-0.00	-0.01	-0.01	0.02	-0.15	-0.09	-0.05	0.55	-0.39	-0.30
NOR	401,917	214	-0.08	0.01	-0.17	0.09	-0.14	-0.20	0.73	-0.17	0.09	-0.17	0.40	0.50	0.30	0.10	0.10	0.04	0.13	0.01	-0.00	0.02	-0.01	0.01	-0.24	0.03	-0.07	0.21	-0.18	0.10
AUT	403,501	325	-0.22	0.01	-0.04	-0.18	-0.04	-0.10	0.76	-0.28	-0.20	-0.16	0.15	0.17	0.24	-0.21	-0.05	0.03	-0.17	-0.02	0.00	-0.00	0.03	-0.05	0.05	-0.12	0.01	-0.21	-0.12	-0.15
CZE	331,335	414	-0.15	-0.02	0.04	-0.38	0.26	0.20	-0.38	-0.01	0.09	0.15	-0.35	-0.33	-0.21	-0.45	0.17	-0.16	-0.33	-0.15	0.00	-0.03	-0.08	0.05	0.48	0.49	-0.26	-0.24	-0.01	-0.30
FIN	395,462	994	-0.54	0.02	-0.21	0.25	-0.14	-0.15	-0.34	0.08	-0.05	-0.11	-0.18	-0.02	0.09	0.25	0.19	-0.08	0.36	-0.06	0.00	-0.01	-0.08	0.00	0.09	0.21	-0.15	-0.55	-0.06	-0.04
MEX	192,441	119	0.24	0.00	0.09	-0.19	-0.07	0.07	-0.31	0.70	0.31	0.14	-0.18	-0.12	-0.20	-0.27	0.22	-0.12	-0.25	0.01	-0.00	0.01	-0.02	0.06	-0.17	0.04	0.08	0.13	0.10	0.20
GRC	246,557	272	-0.15	0.01	-0.16	0.18	-0.13	-0.15	0.66	-0.06	-0.04	-0.19	0.16	0.24	0.13	0.17	0.02	0.06	0.28	-0.06	0.00	0.02	-0.02	0.00	-0.23	-0.10	-0.15	-0.07	-0.32	-0.07
ARG	135,099	81	0.29	-0.02	0.11	-0.26	0.22	0.14	-0.17	-0.09	0.07	0.10	-0.15	-0.24	-0.05	-0.23	0.05	0.03	-0.24	0.05	-0.00	-0.01	-0.02	0.01	0.11	-0.03	0.04	0.35	-0.27	0.11
ISR	204,154	144	0.06	-0.00	-0.14	-0.25	0.00	-0.21	0.28	0.44	0.34	-0.04	0.28	0.32	0.06	-0.30	-0.00	-0.04	-0.23	-0.06	-0.00	-0.01	-0.01	-0.02	0.14	0.02	0.01	0.16	0.14	0.04
THA	186,695	6,697	-0.20	0.01	-0.23	1.93	-0.13	-0.51	-0.05	-0.79	-0.77	-0.28	0.96	0.83	0.64	1.88	0.22	-0.05	1.53	0.17	-0.00	0.02	-0.05	0.01	-0.25	0.28	0.05	0.02	0.07	0.30
NZL	147,677	169	0.04	0.01	0.15	-0.18	-0.16	0.26	-0.08	-0.08	0.11	0.10	-0.40	-0.45	-0.05	-0.15	-0.05	0.12	-0.21	0.11	0.00	0.02	0.08	-0.05	-0.33	-0.07	0.04	-0.25	0.05	0.09
MYS	123,291	242	0.13	0.01	0.31	-0.52	-0.09	0.28	-0.60	0.51	0.28	0.21	-0.48	-0.41	-0.43	-0.54	-0.06	-0.09	-0.51	-0.03	-0.00	-0.01	0.07	0.07	0.18	-0.10	0.05	0.16	-0.21	0.29
IRL	192,161	489	-0.15	0.01	0.01	-0.11	-0.11	-0.02	-0.46	0.19	-0.13	0.05	-0.15	-0.10	-0.14	-0.16	-0.10	-0.02	-0.07	-0.07	0.00	-0.01	0.21	-0.12	0.15	-0.00	0.05	-0.36	0.13	0.05
CHL	127,798	118	0.18	-0.02	-0.05	-0.01	0.17	-0.19	0.17	-0.07	0.17	-0.07	0.34	0.19	0.11	0.03	-0.05	0.06	0.01	0.05	-0.00	-0.02	-0.05	0.08	0.26	0.12	-0.03	0.17	-0.13	0.27
HUN	156,584	202	0.05	-0.01	0.00	-0.19	0.10	0.05	-0.05	-0.39	-0.42	0.06	-0.01	-0.01	-0.00	-0.18	-0.07	0.07	-0.19	0.05	-0.00	-0.00	0.01	-0.03	0.02	-0.14	0.05	0.38	-0.21	0.11
PAK	94,225	479	-0.11	0.03	0.05	0.35	-0.34	0.14	-0.61	-0.11	0.14	0.07	-0.47	-0.47	-0.05	0.45	-0.14	0.06	0.37	0.09	0.00	0.03	0.02	0.05	-0.40	-0.10	0.08	-0.25	0.12	-0.46
EGY	96,241	488	0.65	-0.05	-0.21	1.40	0.48	-0.53	0.36	-0.36	-0.18	-0.36	1.04	0.92	1.52	0.07	-0.15		1.32	0.13	-0.00	-0.03	0.06	-0.00	0.36	0.10	-0.20	0.98	-0.26	0.12
SAU	145,007	1,356	0.04	-0.00	-0.08	0.80	0.01	-0.45	0.70	-0.37	-0.02	-0.29	0.70	0.90	0.66	0.98	-0.03	-0.22	0.79	0.15	0.00	0.01	0.05	-0.02	-0.15	0.17	-0.28	-0.05	-0.05	0.04
SGP	118,386	226	0.04	0.01	-0.09	0.98	-0.16	-0.35	0.75	-0.69	-0.28	-0.25	0.97	0.93	0.59	1.03	0.11	-0.10	0.82	0.15	0.00	0.03	0.03	0.03	-0.39	0.21	-0.02	0.04	0.06	0.17
ROU	80,139	114	0.30	-0.02	0.06	-0.06	0.22	0.16	-0.41	-0.17	-0.18	0.14	-0.28	-0.23	-0.17	-0.08	0.04	-0.06	-0.11	0.07	-0.00	-0.00	0.02	-0.01	0.02	0.11	-0.02	0.66	0.07	0.21
SRB	85,290	398	0.07	-0.06	0.42	-0.89	0.64	0.53	-0.61	-0.17	-0.03	0.34	-0.57	-0.61	-0.50	-0.91	-0.03	-0.10	-0.90	-0.07	0.00	-0.06	-0.06	0.01	0.87	-0.20	0.30	-0.36	0.54	-0.22
SVK	74,869	127	0.09	-0.02	-0.01	-0.16	0.24	0.00	-0.26	-0.05	0.02	0.12	0.09	-0.03	-0.04	-0.14	0.03	-0.04	-0.20	0.11	-0.00	-0.06	0.07	0.06	0.07	0.04	0.00	0.04	0.14	0.11
HRV	61,990	123	0.15	-0.05	0.29	-0.81	0.52	0.46	-0.51	-0.06	0.32	0.28	-0.54	-0.56	-0.48	-0.81	0.07	-0.10	-0.81	0.03	0.00	-0.08	-0.06	0.01	1.03	0.24	0.06	-0.16	0.42	-0.23
SVN	55,977	206	0.64	-0.05	0.35	-0.91	0.45	0.68	-0.87	-0.21	0.05	0.40	-0.78	-0.75	-0.59	-0.94	-0.03	0.04	-0.90	-0.39	-0.00	-0.03	-0.06	-0.01	0.42	0.28	-0.09	-0.25	-0.13	0.26
BGR	52,172	91	0.38	-0.03	-0.10	0.05	0.24	-0.24	0.30	-0.05	0.36	-0.03	0.46	0.42	0.29	0.12	0.04	-0.02	0.00	0.15	-0.00	-0.00	-0.00	-0.00	0.01	0.08	-0.05	0.43	0.03	0.17
EST	75,920	357	0.08	-0.01	0.03	0.32	0.07	0.09	0.61	-0.68	-0.38	-0.08	0.09	-0.01	0.35	0.35	0.10	-0.05	0.22	0.14	-0.00	0.03	0.04	-0.02	-0.36	0.18	-0.03	0.53	-0.31	0.23

Table S5: Relative importances of the categories for countries in Mathematics & Computer science for $\delta = 10$ years

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	4,643,439	299	0.02	0.91	0.51	0.07	0.07	0.04	0.01	0.00	0.00	0.05	0.01	0.01	0.47	0.12	0.04	0.05	0.15	0.12	0.14	0.14	0.05	0.06	0.01	0.00	0.01	0.00	0.00	0.00
CHN	1,283,720	268	-0.33	0.03	0.07	0.03	-0.29	0.17	-0.15	0.11	0.45	0.01	-0.36	-0.34	-0.18	0.05	0.15	-0.07	0.10	-0.00	0.00	0.02	-0.05	0.08	-0.28	-0.03	-0.12	-0.29	-0.11	-0.36
USA	1,131,649	279	-0.50	-0.01	-0.04	-0.34	0.32	0.20	-0.23	0.90	-0.38	0.12	-0.37	-0.24	-0.37	-0.32	-0.09	0.13	-0.28	-0.01	0.00	-0.02	-0.00	-0.02	0.29	-0.32	0.06	-0.31	-0.29	-0.20
GBR	391,986	201	-0.41	0.03	-0.01	0.08	-0.29	-0.03	0.01	0.24	0.27	-0.05	-0.08	-0.16	0.05	0.16	-0.09	0.16	0.12	0.08	0.00	0.02	-0.04	0.07	-0.28	-0.24	-0.03	-0.27	-0.21	-0.16
FRA	359,777	156	-0.41	-0.01	-0.16	0.07	0.33	-0.09	0.08	0.32	0.54	-0.06	-0.13	-0.08	-0.13	-0.06	-0.07	0.02	0.11	-0.12	0.00	-0.02	-0.01	-0.01	0.32	-0.02	0.05	-0.41	0.14	-0.15
DEU	334,192	101	-0.45	0.00	0.04	-0.05	0.17	0.39	-0.50	-0.10	-0.12	0.16	-0.50	-0.53	-0.23	-0.07	-0.16	0.16	-0.05	0.02	0.00	-0.01	0.06	-0.06	0.09	-0.11	0.11	-0.44	0.17	-0.15
ITA	292,600	296	-0.08	-0.03	-0.05	-0.19	0.48	0.31	-0.61	1.04	0.25	0.18	-0.50	-0.47	-0.39	-0.23	-0.06	0.05	-0.17	-0.03	0.00	-0.04	-0.03	0.01	0.70	0.20	0.03	-0.15	0.87	-0.41
CAN	214,910	179	-0.39	0.04	-0.16	0.21	-0.44	-0.22	-0.21	0.37	0.41	-0.07	0.09	0.02	0.11	0.25	-0.27	0.31	0.28	0.02	0.00	0.02	-0.02	0.06	-0.33	-0.29	0.10	-0.34	-0.35	-0.36
ESP	293,019	270	-0.08	-0.03	-0.06	-0.46	0.50	0.33	-0.52	1.12	0.24	0.21	-0.45	-0.45	-0.39	-0.49	-0.40	0.33	-0.36	-0.17	0.00	-0.03	-0.01	-0.07	0.57	-0.39	0.10	-0.26	-0.06	-0.57
KOR	250,835	134	-0.20	0.01	-0.03	-0.44	-0.00	-0.08	0.36	0.30	0.99	-0.06	-0.28	0.00	-0.36	-0.44	-0.32	0.11	-0.35	-0.01	0.00	0.10	-0.07	0.10	-0.30	-0.01	-0.54	-0.35	-0.46	
JPN	227,246	249	-0.21	-0.05	0.16	-0.57	0.74	0.64	-0.71	0.89	0.17	0.32	-0.69	-0.66	-0.67	-0.72	-0.07	0.02	-0.57	-0.32	0.00	-0.04	0.06	-0.06	0.73	-0.23	0.21	-0.07	-0.17	-0.45
TWN	161,713	255	-0.15	0.01	0.08	-0.17	-0.12	0.17	1.23	-0.43	0.20	-0.38	-0.17	-0.04	-0.06	-0.25	-0.06	0.14	0.02	-0.24	0.00	0.01	0.14	-0.10	-0.13	-0.14	-0.17	-0.10	-0.66	-0.73
AUS	148,597	403	-0.42	0.05	0.09	0.14	-0.49	-0.18	0.07	0.05	0.48	-0.17	0.03	0.02	0.28	0.22	0.44	-0.25	0.22	0.04	0.00	0.02	0.00	-0.00	-0.31	0.02	-0.21	-0.10	-0.27	-0.44
IRN	80,026	160	-0.02	0.03	-0.04	-0.33	-0.35	-0.20	0.16	0.63	0.94	-0.06	0.07	-0.00	-0.32	-0.62	-0.20	0.13	-0.23	-0.49	0.00	0.01	-0.06	0.04	-0.17	-0.30	0.17	-0.43	0.30	-0.10
IND	77,153	123	0.33	-0.02	0.17	-0.26	0.14	0.34	0.76	-0.73	-0.02	-0.14	-0.26	-0.18	-0.06	-0.25	0.31	-0.09	-0.26	0.06	-0.00	0.01	0.09	-0.12	-0.13	-0.31	0.18	0.74	-0.57	-0.52
BRA	94,752	91	-0.01	-0.02	-0.18	-0.44	0.31	-0.48	-0.07	0.87	0.43	0.06	0.43	0.51	-0.13	-0.63	-0.15	-0.02	-0.36	-0.40	0.00	-0.04	-0.14	0.09	0.59	-0.06	0.01	-0.22	0.17	-0.34
NLD	122,442	97	-0.24	0.00	0.07	0.06	0.08	0.21	-0.40	-0.40	-0.43	0.10	-0.33	-0.35	-0.20	0.07	-0.01	-0.00	-0.00	0.12	0.00	-0.01	0.08	-0.11	0.11	-0.03	0.05	-0.28	0.41	-0.09
TUR	53,235	237	-0.25	0.05	0.20	0.05	-0.58	-0.15	0.84	-0.05	0.22	-0.24	0.27	0.18	0.33	0.11	-0.07	-0.01	0.05	0.09	0.00	0.04	0.13	-0.06	-0.63	-0.32	-0.14	-0.38	-0.35	0.39
SGP	97,915	267	-0.42	0.03	0.01	0.02	-0.23	0.20	-0.59	-0.47	-0.05	0.10	-0.38	-0.39	-0.18	0.03	-0.47	0.53	-0.01	0.09	0.00	-0.00	-0.02	-0.13	0.00	-0.39	0.31	-0.68	0.29	-0.33
POL	70,217	132	0.02	-0.01	0.12	0.20	0.15	0.19	-0.19	-0.54	-0.29	0.12	-0.24	-0.14	0.13	0.23	-0.08	0.18	0.10	0.16	0.00	0.02	0.03	0.02	-0.32	-0.02	-0.15	-0.41	0.14	0.24
RUS	77,732	76	0.03	-0.04	0.16	-0.00	0.51	0.33	-0.53	-0.19	-0.20	0.16	-0.44	-0.43	-0.28	0.03	-0.04	-0.08	-0.00	0.08	-0.00	-0.02	-0.01	0.02	0.40	0.16	-0.07	0.62	0.31	-0.20
BEL	116,239	605	-0.55	0.00	0.07	-0.61	0.17	0.35	-0.78	0.72	0.60	0.32	-0.36	-0.46	-0.37	-0.68	-0.05	-0.04	-0.60	-0.17	0.00	-0.04	0.00	0.04	0.59	0.24	0.03	-0.53	0.89	-0.51
CHE	107,402	151	-0.61	-0.00	-0.12	-0.04	0.34	-0.04	-0.48	0.13	-0.02	0.16	-0.05	-0.02	-0.03	0.02	-0.21	0.03	-0.07	0.14	0.00	-0.01	-0.01	-0.00	0.22	-0.14	0.09	-0.59	-0.09	-0.27
SWE	78,753	116	-0.20	0.01	-0.02	0.46	0.00	0.33	-0.60	-0.30	-0.01	0.13	-0.50	-0.49	-0.10	0.52	-0.06	0.02	0.37	0.15	0.00	0.01	0.04	0.06	-0.16	0.14	0.03	-0.12	0.33	0.19
GRC	60,800	231	0.74	-0.02	0.09	-0.03	-0.03	-0.06	0.06	-0.61	-0.63	-0.05	0.09	0.08	0.17	-0.05	0.39	-0.31	-0.06	0.06	-0.00	-0.01	-0.04	-0.07	0.16	0.17	0.08	0.18	-0.32	0.59
ISR	43,915	84	-0.05	0.02	-0.18	0.24	-0.30	-0.39	0.81	0.81	0.45	-0.30	0.55	0.07	0.21	0.35	0.05	0.12	0.40	0.00	0.00	0.02	-0.04	0.03	-0.39	-0.33	-0.26	-0.02	0.18	-0.35
PRT	59,001	174	1.07	-0.03	-0.25	0.10	-0.01	-0.23	-0.19	-0.17	-0.24	-0.04	0.05	0.06	0.08	0.02	0.24	-0.25	0.07	-0.00	-0.00	-0.02	-0.00	-0.01	0.29	-0.25	0.27	0.42	0.79	-0.18
AUT	53,925	76	-0.31	-0.01	-0.09	-0.14	0.34	-0.13	-0.24	-0.32	-0.18	0.07	0.13	0.20	0.02	-0.16	-0.15	0.21	-0.13	-0.00	0.00	-0.03	-0.02	0.02	0.44	0.21	-0.02	-0.23	0.17	-0.31
FIN	60,008	129	-0.12	-0.01	-0.06	0.17	0.20	0.10	-0.45	-0.56	-0.32	0.08	-0.21	-0.19	-0.08	0.22	-0.10	0.03	0.16	0.10	0.00	0.00	0.25	0.03	0.12	0.25	-0.04	-0.14	0.00	-0.14
SAU	45,928	1,530	-0.06	0.03	-0.11	1.30	-0.39	-0.30	0.39	-0.68	-0.25	-0.30	0.41	0.53	0.40	1.44	0.17	-0.24	1.15	0.18	0.00	0.03	0.08	0.01	-0.49	0.27	-0.11	-0.20	-0.08	0.24
CZE	39,860	168	-0.14	-0.02	0.08	-0.04	0.29	0.17	-0.41	-0.22	-0.57	0.11	-0.22	-0.28	0.02	-0.16	0.09	-0.16	-0.09	-0.04	0.00	-0.03	0.04	-0.02	0.42	0.15	0.11	-0.04	0.49	0.07
ROU	30,765	297	-0.23	0.05	0.33	-0.11	-0.55	-0.08	0.89	-0.14	0.02	-0.19	0.37	0.23	0.42	-0.06	-0.11	-0.03	-0.15	0.16	0.00	-0.00	0.04	0.10	-0.68	0.36	-0.31	-0.20	0.32	0.50
DNK	46,654	220	-0.40	0.03	-0.12	0.47	-0.30	0.28	-0.57	-0.63	-0.39	0.14	-0.53	-0.23	0.04	0.51	1.26	-0.71	0.32	0.19	0.01	0.03	-0.26	0.16	-0.43	1.10	-0.29	-0.80	0.29	0.30
NOR	35,979	142	-0.42	0.04	0.26	-0.31	-0.45	-0.14	0.53	-0.69	-0.56	-0.17	0.40	0.54	0.42	-0.26	0.16	-0.01	-0.32	0.14	-0.00	0.06	-0.06	-0.16	0.21	-0.01	0.09	0.16	0.21	
MYS	33,254	473	0.07	0.01	0.40	-0.78	-0.22	0.74	-0.85	0.09	-0.20	0.35	-0.78	-0.76	-0.73	-0.79	-0.34	0.16	-0.78	-0.05	0.00	-0.04	0.01	-0.03	0.73	-0.38	0.38	-0.56	-0.34	0.85
MEX	26,210	86	0.17	-0.03	-0.11	-0.34	0.37	-0.30	-0.25	0.18	0.12	0.12	0.43	0.24	0.06	-0.39	0.19	-0.27	-0.27	-0.12	-0.00	-0.02	-0.22	0.15	0.41	0.75	-0.21	0.19	-0.07	-0.37
IRL	34,129	386	0.74	0.00	0.44	-0.50	-0.34	0.53	0.43	-0.80	-0.83	-0.13	-0.52	-0.60	0.23	-0.47	0.17	-0.02	-0.52	0.15	-0.00	-0.02	0.19	-0.30	0.29	-0.64	0.49	0.05	-0.77	1.18
ZAF	15,775	135	0.33	0.02	-0.10	1.04	-0.42	-0.35	0.04	-0.46	-0.17	-0.15	0.24	0.76	0.32	1.05	0.45	-0.23	0.84	0.16	0.00	0.03	0.04	0.01	-0.50	0.67	-0.19	-0.02	-0.44	0.68
HUN	19,815	55	0.60	-0.01	-0.17	0.77	-0.17	-0.25	0.51	-0.09	-0.03	-0.27	0.39	0.36	0.26	0.82	0.25	-0.06	0.85	0.04	-0.01	0.02	-0.09	0.08	-0.31	0.06	-0.26	1.51	0.19	0.14
CHL	19,672	86	-0.12	-0.01	-0.24	-0.21	0.17	-0.51	0.55	0.54	0.77	-0.09	0.70	0.51	0.20	-0.21	-0.01	0.16	-0.18	0.01	-0.00	-0.07	-0.03	-0.14	-0.35	-0.14	0.29	0.32	0.12	
NZL	19,400	70	-0.21	0.01	-0.04	0.17	-0.08	-0.34	0.46	0.46	-0.25	-0.10	0.53	0.34	0.09	0.09	0.02	0.17	0.10	0.03	0.00	0.02	-0.13	0.09	-0.33	0.09	0.06	-0.12	-0.12	0.30
SRB	16,698	119	0.41	-0.02	0.03	-0.73	0.07	0.43	-0.51	-0.07	-0.71	0.32	-0.35	-0.39	-0.21	-0.71	0.04	0.19	-0.71	0.09	-0.02	0.02	0.10	-0.05	-0.40	0.25	0.07	3.08	-0.10	-0.64
SVN	16,564	92	-0.00	-0.02	0.14	-0.58	0.32	0.38	-0.48	0.61	0.57	0.19	-0.46	-0.56	-0.25	-0.65	-0.13	0.15	-0.52	-0.23	-0.00	-0.06	0.01	-0.00	0.93	0.13	0.10	0.05	-0.06	0.17
DZA	14,719	67	-0.17	-0.03	-0.08	0.07	0.45	-0.48	-0.12	-0.23	0.30	0.03	0.76	0.39	0.26	0.04	0.02	-0.00	-0.04	0.13	0.00	-0.03	-0.25	0.19	0.46	0.29	0.04	-0.29	0.09	0.41
EGY	13,937	509	0.74	-0.08	-0.10	1.16	0.83	-0.19	1.06	-0.62	-0.54	-0.38	0.42	0.96	0.43	1.36	-0.13	-0.05	1.04	0.21	-0.00	-0.01	0.01	0.02	0.13	0.15	-0.09	0.35	-0.37	0.44
THA	12,739	257	2.52	-0.06	-0.04	-0.75	-0.19	-0.70	-0.16	0.21	0.05	0.21	0.91	0.38	0.31	-0.89	-0.52	-0.39	-0.61	-0.72	0.00	0.04	0.00	-0.07	-0.65	-0.55	0.46	-0.64	-0.52	0.94
PAK	16,841	2,112	0.02	0.05	-0.26	1.89	-0.69	-0.44	0.33	-0.36	-0.16	-0.33	0.47	0.78	0.37	2.16	0.12	-0.13	1.88	0.14	-0.00	0.05	0.22	-0.05	-0.78	0.15	-0.00	0.02	0.36	-0.05
UKR	16,910	50	0.19	-0.04	-0.06	0.13	0.41	-0.23	0.38	-0.70	-0.67	-0.06	0.71	0.47	0.31	0.22	-0.03	-0.11	0.12	0.14	-0.00	0.01	-0.08	0.10	-0.12	0.18	-0.11	0.56	-0.32	-0.03
SVK	14,609	280	-0.13	0.03	0.07	-0.43	-0.43	-0.12	0.52	-0.46	-0.50	-0.01	0.45	0.52	0.37	-0.45	-0.05	0.11	-0.47	0.09	0.00	0.04	0.00	-0.05	-0.67	0.29	-0.04	-0.44	0.35	0.12
ARG	9,940	55	0.48	-0.02	-0.12	0.84	0.12	-0.13	-0.14	0.17	0.70	0.03	0.08	0.08	0.15	0.82	0.17	-0.04	0.65	0.16	-0.01	0.02	0.03	-0.04	-0.33	-0.13	-0.41	1.31	0.00	0.03
HRV	8,372	103	-0.18	0.04	-0.10	-0.79	-0.45	0.02	0.47	0.23	-0.44	-0.01	0.05	0.21	-0.33	-0.78	0.41	-0.24	-0.76	-0.04	-0.01	0.01	-0.04	0.14	-0.16	0.12	-0.15	0.76	-0.05	0.62

C   Algorithm implementation performance

In this section we investigate the performance of our implementation of the introduced algorithms. All experiments were run on a single machine with 16 Intel Xeon E5-2630v3 CPUs at 2.40 GHz (32 threads) with 512GB RAM. For the previous version of our algorithms we showed that execution at four or eight threads provided optimal performance with respect to runtime (Boekhout *et al.*, 2019). We confirmed this still holds for our extended algorithms and performed all experiments at eight threads. All reported execution runtimes include counting edge, star and triangle motifs but do not include the time required for reading the graph from disk into memory.

In Section 4 we claimed that the time complexities of the extended algorithms increased by small constant factors with respect to the existing algorithms with time complexities $O(m\lambda^2)$, $O(m\lambda^2)$ and $O(m\sqrt{\tau}\lambda^2)$, respectively. Since we have only four layers ($\lambda = 4$), we expect the algorithms to show linear performance with respect to the number of edges in a network. In Figure S12a, we confirm this by comparing the execution runtimes of all our experiments, i.e., the runtimes for all global and country datasets (see Supplementary Material B) for all five fields and three δ values, with respect to the size of the dataset. The figure shows a linear relationship between the size of a dataset and the runtime of our implementation.

In Figure S12b, we show that for datasets with more than ten thousand edges the algorithms process between thirty and fifty thousand edges per second, over eight threads of execution. Additionally, Figure S12c shows that for almost all datasets between three and five thousand nodes are processed per second. As the number of edges in the networks increases, the performance seems to converge to around 40,000 edges and 3,000 nodes per second.

Figure S12d shows that as the datasets get larger their density, i.e., the fraction of edges with respect to all possible edges, decreases. This makes sense, because the primary reason for co-authorship networks to be larger is the inclusion of co-authorships on a greater number of papers. Although there are more papers overall, that does not mean that the average productivity of an author increases, i.e., the average node degree remains constant. In other words, the addition of more papers likely leads to more (new) authors while the

(a) Execution runtimes   (b) Edges per second: size   (c) Nodes per second: size

(d) Density distribution   (e) Edges per second: density   (f) Nodes per second: density
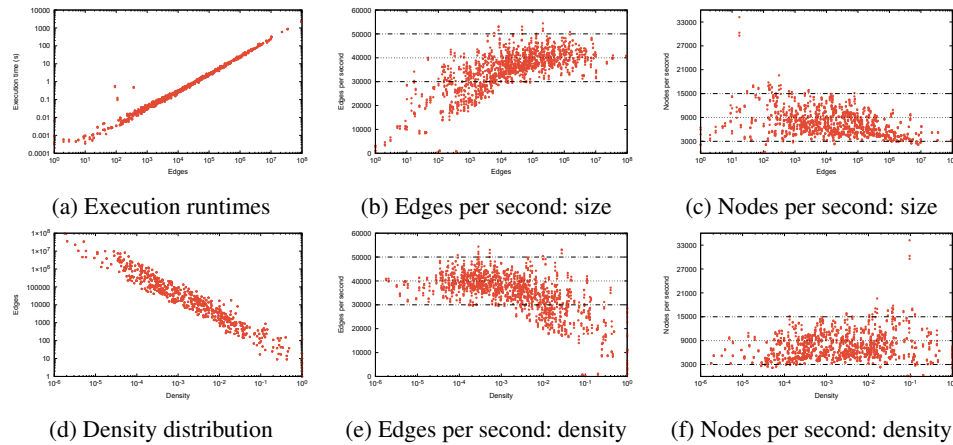
Figure S12: Performance of our algorithm implementation for all experiments

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average degree of authors need not increase. Thus, the addition of more papers creates far more potential edges than it actually adds and as a result decreases the density. A second potential reason for co-authorship networks to be larger is the inclusion of a greater number of authors per paper and therefore a greater number of co-authorships. Although this creates fully connected clusters (cliques) of connected authors, the authors in these clusters are less likely to connect to other clusters and each paper potentially adds a lot of new authors. As such, an increase in authors per paper likely decreases the density. Because the density decreases for both the addition of more papers as well as an increase in the number of authors per paper, Figures S12e and S12f look to simply be the mirror images of Figures S12b and S12c, respectively.

D   Robustness of relative importance

Below we analyze the robustness of the results presented in Section 7.3 of the paper with respect to the chosen time window (δ = 10 years). In order to confirm the robustness of these results, we compared the relative importances (ri) obtained for $\delta = 3, 5$ and 10 years, shown in Table S7. The changes in ri of each category from $\delta = 3 \to 10$ for the global datasets are shown in Table S6. In this table, we see only very small ri differences, with a largest reported difference of 0.09. None of the ri differences are large enough to change the conclusions drawn for any of the fields.

The changes in ri of the categories for countries within the respective fields are shown in Tables S8–S12. Tables for $\delta = 3 \to 5$ and $\delta = 5 \to 10$ were not included because the changes in ri observed in those tables are simply smaller changes in exactly the same positive or negative direction. For most countries and categories only small changes in ri can be observed. However, for some smaller countries, such as Mexico and Columbia in SSH, we see large changes for the smaller categories M2, RFM and VM. Only Thailand in M&C observes large enough changes in the relative importances of the categories to require reconsideration of the conclusions drawn in Section B.2. We had concluded from, amongst others, a low proportion of RFM and high proportion of VM motifs, that the added international collaboration for Thailand in this field is characterized by international

Table S6: Difference in relative importance for $\delta = 3 \to 10$ of each category for all fields

Collaboration categories

field	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE
Social sciences & Humanities	4,609,814	452	0.00	0.00	-0.01	0.06	-0.01	-0.03	0.08	0.04	-0.00	-0.03	0.04	0.09
Biomedical & Health sciences	93,959,336	8,188	0.00	0.00	-0.00	0.01	-0.00	-0.00	-0.00	0.03	-0.01	0.01	-0.01	-0.01
Physical sciences & Engineering	35,167,505	2,331	0.01	-0.00	0.01	-0.03	0.00	0.00	-0.07	-0.05	0.00	0.01	-0.00	-0.02
Life & Earth sciences	22,557,784	704	0.03	-0.00	0.00	0.02	-0.00	0.01	-0.02	-0.03	-0.02	0.01	-0.00	-0.02
Mathematics & Computer science	4,643,439	299	-0.03	-0.00	0.00	-0.05	0.01	0.01	0.01	0.02	0.02	0.00	-0.04	-0.04

International categories

field	edges	mpe	I	IM	IMI	IMO
Social sciences & Humanities	4,609,814	452	0.01	0.00	-0.00	0.00
Biomedical & Health sciences	93,959,336	8,188	0.01	-0.00	-0.00	0.01
Physical sciences & Engineering	35,167,505	2,331	-0.02	-0.02	0.01	-0.01
Life & Earth sciences	22,557,784	704	0.02	0.05	0.02	-0.01
Mathematics & Computer science	4,643,439	299	-0.01	-0.03	-0.02	0.00

Mobility categories

field	edges	mpe	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
Social sciences & Humanities	4,609,814	452	0.04	-0.03	-0.00	0.00	-0.03	0.01	-0.03	0.02	-0.01	0.00	0.00	0.08
Biomedical & Health sciences	93,959,336	8,188	0.01	-0.02	0.00	0.00	-0.01	-0.01	-0.01	-0.06	0.03	0.01	-0.00	-0.01
Physical sciences & Engineering	35,167,505	2,331	-0.03	0.01	0.00	-0.00	0.01	0.00	0.04	0.04	-0.00	-0.01	0.00	-0.04
Life & Earth sciences	22,557,784	704	-0.00	0.05	-0.00	0.00	-0.01	0.01	-0.02	0.03	0.00	0.09	0.01	0.06
Mathematics & Computer science	4,643,439	299	-0.03	0.00	0.00	-0.00	0.04	-0.01	0.03	-0.03	-0.01	-0.09	-0.01	-0.08

knowledge networks formed through foreign scholars that made short term visits to Thailand. Contrary to results for $\delta = 10$ years though, for $\delta = 3$ years we observe a positive *ri* for RFM and a small negative *ri* for VM. Remarkably, this actually strengthens our conclusion. After all, visit mobility from foreign scholars and its effects are less likely to be captured fully in a three year period, whereas after ten years we can observe the strength of the collaboration relationships build through visit mobility from their continued collaboration. In other words, the substantial increase of the proportion of visit mobility (VM) motifs from a $\delta = 3$ to 10 years, highlights that much international collaboration can be associated with knowledge networks formed through visit mobility.

We conclude that for larger datasets the relative importances computed for $\delta = 10$ years are robust and that for smaller datasets a check is required for variations for different δ. We found that the conclusions drawn in Section 7.3 and B.2 hold up under this check.

Table S7: Field comparison, relative importances for all fields for $\delta = 3, 5$ and 10 years

	field	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
$\delta=3$	SSH	4,609,814	207	0.10	-0.01	-0.06	-0.14	0.14	-0.10	0.91	-0.18	-0.24	-0.19	0.32	0.42	-0.18	-0.25	-0.04	0.04	-0.08	-0.16	-0.00	-0.01	-0.02	0.00	0.18	-0.08	-0.03	0.36	-0.22	-0.05
	B&H	93,959,336	3,751	-0.43	-0.00	0.15	-0.38	0.12	0.31	-0.48	-0.00	-0.07	0.16	-0.59	-0.59	-0.42	-0.48	-0.01	-0.00	-0.36	-0.16	0.00	-0.01	0.00	-0.01	0.18	0.03	0.04	-0.41	0.12	-0.06
	P&E	35,167,505	1,180	-0.04	0.01	-0.04	0.23	-0.09	-0.12	0.10	-0.05	0.16	-0.06	0.22	0.17	0.23	0.31	-0.00	-0.02	0.18	0.14	0.00	0.01	0.02	-0.01	-0.09	0.10	-0.04	-0.10	0.11	0.11
	L&E	22,557,784	335	-0.09	0.01	-0.08	0.31	-0.07	-0.07	-0.29	0.08	-0.01	0.01	0.02	-0.01	0.16	0.37	0.01	0.02	0.29	0.08	0.00	0.01	0.00	-0.00	-0.09	0.04	-0.00	-0.17	0.13	0.01
	M&C	4,643,439	153	0.46	0.00	0.02	-0.01	-0.09	-0.02	-0.24	0.16	0.16	0.07	0.03	0.01	0.20	0.05	0.04	-0.03	-0.02	0.10	-0.00	0.01	-0.00	0.01	-0.18	-0.09	0.02	0.32	-0.15	-0.01
$\delta=5$	SSH	4,609,814	344	0.11	-0.01	-0.06	-0.11	0.13	-0.12	0.96	-0.17	-0.25	-0.21	0.34	0.47	-0.17	-0.25	-0.04	0.04	-0.06	-0.18	-0.00	-0.01	-0.04	0.01	0.16	-0.06	-0.03	0.36	-0.21	0.00
	B&H	93,959,336	6,191	-0.42	-0.00	0.15	-0.37	0.11	0.31	-0.48	0.00	-0.06	0.17	-0.59	-0.59	-0.41	-0.48	-0.01	0.00	-0.36	-0.17	0.00	-0.01	-0.01	-0.01	0.17	0.00	0.05	-0.39	0.12	-0.07
	P&E	35,167,505	1,867	-0.05	0.01	-0.03	0.21	-0.09	-0.12	0.05	-0.09	0.15	-0.05	0.23	0.16	0.22	0.30	0.01	-0.03	0.17	0.14	0.00	0.01	0.03	-0.01	-0.07	0.13	-0.04	-0.11	0.11	0.10
	L&E	22,557,784	549	-0.07	0.01	-0.07	0.32	-0.08	-0.06	-0.31	0.06	-0.02	0.02	0.02	-0.03	0.17	0.40	0.02	0.02	0.29	0.11	0.00	0.01	0.00	-0.00	-0.10	0.04	0.00	-0.12	0.15	0.04
	M&C	4,643,439	238	0.43	0.00	0.02	-0.05	-0.08	-0.01	-0.23	0.19	0.17	0.08	0.00	-0.01	0.19	0.03	0.02	-0.03	-0.04	0.10	-0.00	0.01	0.02	0.01	-0.16	-0.11	0.02	0.26	-0.16	-0.07
$\delta=10$	SSH	4,609,814	452	0.11	-0.01	-0.07	-0.09	0.13	-0.13	0.99	-0.15	-0.25	-0.22	0.37	0.51	-0.17	-0.25	-0.04	0.04	-0.04	-0.20	-0.00	-0.01	-0.05	0.01	0.15	-0.06	-0.04	0.36	-0.21	0.02
	B&H	93,959,336	8,188	-0.42	-0.00	0.15	-0.37	0.12	0.31	-0.48	0.00	-0.07	0.17	-0.60	-0.60	-0.41	-0.48	-0.02	0.01	-0.35	-0.19	0.00	-0.01	-0.01	-0.02	0.17	-0.03	0.07	-0.40	0.12	-0.07
	P&E	35,167,505	2,331	-0.05	0.01	-0.03	0.19	-0.09	-0.12	0.03	-0.10	0.16	-0.05	0.22	0.15	0.21	0.29	0.01	-0.03	0.15	0.15	0.00	0.00	0.03	-0.01	-0.05	0.14	-0.04	-0.11	0.12	0.07
	L&E	22,557,784	704	-0.06	0.01	-0.07	0.33	-0.08	-0.05	-0.32	0.05	-0.02	0.02	0.02	-0.04	0.18	0.42	0.03	0.01	0.28	0.13	0.00	0.01	0.01	-0.00	-0.12	0.07	-0.00	-0.08	0.14	0.07
	M&C	4,643,439	299	0.43	0.00	0.02	-0.06	-0.08	-0.01	-0.22	0.18	0.18	0.08	-0.01	-0.02	0.19	0.03	0.01	-0.03	-0.05	0.11	-0.00	0.01	0.04	0.01	-0.15	-0.12	0.01	0.23	-0.16	-0.09

Table S8: Relative importance differences of the categories for countries in Social sciences & Humanities for deltas 3→10

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	4,609,814	244.8	-0.00	0.01	-0.01	0.01	-0.01	-0.01	-0.00	0.00	-0.00	-0.01	-0.00	-0.00	-0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	-0.00	-0.00	0.00	0.00	0.00
USA	2,262,767	304.7	-0.02	0.00	0.01	0.03	-0.01	0.01	0.13	0.03	-0.10	-0.06	-0.03	0.04	-0.00	-0.03	-0.01	0.03	0.02	-0.07	0.00	0.01	-0.05	-0.00	-0.07	-0.05	0.01	-0.05	-0.04	0.11
GBR	694,382	121.6	-0.02	0.00	-0.01	0.04	-0.04	-0.02	0.02	-0.01	-0.02	-0.01	0.03	0.04	0.02	0.06	0.04	-0.01	0.06	-0.01	-0.00	0.00	-0.02	-0.01	-0.05	-0.01	-0.03	0.02	0.00	0.05
CAN	418,643	144.5	0.00	0.01	-0.03	0.11	-0.04	-0.08	-0.01	0.22	0.09	-0.05	-0.04	0.03	0.07	0.16	-0.04	0.07	0.14	0.02	0.00	0.00	0.03	-0.06	-0.01	-0.01	-0.07	-0.04	0.06	-0.07
DEU	395,401	175.2	-0.03	0.00	-0.00	0.05	-0.02	-0.00	0.05	0.06	-0.02	-0.04	-0.04	-0.08	-0.00	-0.00	0.00	-0.01	0.05	-0.05	0.00	-0.00	-0.02	-0.02	-0.01	-0.10	0.05	-0.15	0.01	0.09
AUS	348,347	101.6	-0.03	-0.01	-0.01	-0.08	0.05	-0.00	0.05	0.09	-0.05	-0.02	-0.02	0.04	-0.04	-0.11	0.04	-0.07	-0.06	-0.07	0.00	-0.00	0.03	-0.03	0.05	0.01	-0.02	-0.09	-0.07	0.10
NLD	339,059	373.0	0.00	-0.00	0.02	-0.01	-0.02	0.05	0.01	0.13	-0.04	-0.01	-0.08	-0.06	-0.01	-0.03	-0.01	-0.00	-0.01	-0.03	0.00	-0.00	-0.03	-0.01	0.01	-0.06	0.03	-0.02	-0.03	0.03
CHN	226,770	32.5	-0.00	-0.00	0.00	-0.04	-0.02	0.02	0.11	-0.17	-0.04	-0.04	-0.03	-0.01	0.01	-0.01	-0.01	-0.01	-0.02	0.01	-0.00	-0.00	-0.02	-0.01	-0.02	-0.02	0.04	-0.06	0.02	0.16
ESP	222,105	107.7	-0.02	0.00	-0.03	0.09	-0.02	-0.03	-0.05	0.14	0.08	-0.00	-0.04	0.06	-0.02	0.02	-0.03	0.07	0.10	-0.04	0.00	0.01	-0.09	0.07	-0.12	0.14	-0.02	-0.05	-0.03	0.02
ITA	210,865	257.0	0.03	-0.00	0.05	-0.01	0.03	0.09	0.19	-0.19	-0.07	-0.05	0.10	-0.03	0.06	-0.01	0.07	-0.03	-0.02	-0.02	0.00	0.01	-0.03	0.01	-0.08	-0.05	0.01	-0.01	0.02	-0.14
FRA	195,373	41.0	-0.05	0.00	-0.01	0.02	-0.02	-0.01	-0.06	0.05	0.04	0.01	-0.01	-0.02	0.00	0.04	-0.01	0.01	0.05	-0.01	0.00	0.00	0.00	-0.02	-0.08	0.04	-0.11	-0.13	-0.01
SWE	134,514	207.1	-0.04	0.00	0.00	-0.01	-0.05	0.00	0.14	-0.06	-0.14	-0.05	0.05	0.00	-0.01	0.03	0.00	-0.04	0.02	-0.00	0.01	-0.04	0.02	-0.09	0.05	-0.04	0.09	-0.12	0.13
CHE	119,528	88.4	-0.03	-0.00	-0.00	0.03	0.01	0.05	0.05	-0.08	0.01	0.00	-0.05	-0.08	-0.01	0.03	0.01	0.05	0.01	0.01	0.00	0.00	0.03	-0.02	-0.07	-0.05	0.06	0.04	0.07	0.03
BEL	112,156	128.5	0.00	0.00	-0.02	0.01	-0.03	-0.03	-0.07	-0.04	-0.04	0.05	-0.00	0.09	-0.01	0.04	-0.02	0.01	0.02	0.02	0.00	-0.00	0.01	-0.00	-0.02	-0.05	-0.02	-0.03	0.07	0.00
JPN	102,284	158.8	-0.02	-0.00	-0.01	0.20	0.07	-0.01	-0.02	0.17	-0.30	-0.08	-0.09	0.06	-0.07	-0.05	-0.01	0.06	0.17	-0.10	0.00	0.00	-0.04	0.08	0.25	-0.11	-0.02	0.06	-0.05
TWN	54,248	47.0	-0.04	-0.01	0.03	0.05	0.09	-0.03	0.08	-0.15	-0.15	-0.09	0.06	-0.03	0.03	0.07	0.05	-0.03	0.04	0.02	0.00	-0.01	0.09	-0.08	0.15	0.16	-0.09	-0.09	-0.11	0.22
KOR	62,022	10.8	-0.02	-0.00	0.01	-0.03	-0.02	-0.01	0.02	0.00	0.05	0.00	-0.01	-0.05	-0.01	-0.00	0.00	-0.07	-0.00	-0.01	-0.01	0.02	-0.09	-0.09	0.08					
ISR	60,720	34.6	-0.04	-0.00	-0.03	0.14	0.00	-0.06	-0.08	0.26	0.16	0.02	-0.10	-0.10	-0.00	0.09	0.10	-0.06	0.10	-0.01	0.00	-0.00	-0.07	0.05	0.01	0.11	0.07	-0.14	0.25	-0.07
BRA	82,995	20.8	-0.01	-0.00	-0.05	0.08	0.04	-0.10	0.10	0.11	0.05	-0.08	0.08	0.11	-0.01	-0.02	0.03	0.06	0.05	-0.07	0.00	-0.00	-0.07	0.05	0.07	-0.00	0.06	-0.06	0.04	0.15
NOR	78,131	51.2	-0.08	0.00	-0.00	-0.00	0.02	-0.03	0.00	0.18	-0.01	-0.01	0.13	0.10	-0.01	0.01	0.01	0.03	0.00	0.00	0.00	-0.01	-0.02	0.05	0.09	-0.05	-0.04	-0.05	0.01	0.06
ZAF	60,570	48.5	-0.05	-0.00	-0.02	0.02	0.02	0.01	0.01	-0.14	0.08	-0.00	-0.02	0.09	-0.00	-0.05	0.05	-0.02	-0.08	0.01	0.00	-0.00	0.09	0.06	0.02	0.11	0.02	-0.09	-0.00	-0.00
FIN	80,721	231.0	-0.02	0.00	-0.01	0.01	-0.02	-0.03	-0.01	0.35	0.46	-0.02	0.01	0.03	0.02	0.02	0.07	-0.04	0.04	-0.02	0.00	-0.00	-0.05	-0.01	0.02	-0.03	-0.03	-0.04	-0.10	0.10
DNK	74,133	71.3	-0.07	-0.00	0.01	-0.09	0.03	0.01	0.06	-0.09	-0.04	0.02	-0.03	0.05	0.01	-0.09	0.03	-0.04	-0.08	-0.02	0.00	0.00	-0.01	0.00	-0.03	-0.01	-0.07	-0.13	0.06	0.08
TUR	41,516	7.6	-0.10	-0.00	-0.05	-0.28	0.04	-0.06	-0.06	0.20	0.15	0.02	-0.02	0.06	-0.15	-0.32	-0.17	0.03	-0.23	-0.11	0.00	-0.02	0.06	-0.02	0.18	-0.13	0.12	-0.24	0.24	-0.17
NZL	50,698	561.8	0.04	-0.00	0.04	0.01	0.06	0.08	0.13	-0.16	-0.03	-0.01	-0.02	-0.03	0.02	0.02	0.10	0.00	0.11	-0.00	0.01	0.02	0.02	-0.14	0.03	-0.10	0.36	0.14	-0.13
PRT	51,362	49.4	0.03	-0.01	-0.01	0.02	0.05	-0.08	0.15	0.14	0.09	-0.09	0.10	0.09	0.07	0.06	0.03	-0.04	0.04	0.01	-0.00	0.00	0.08	-0.07	0.01	0.02	-0.10	0.10	-0.10	0.23
AUT	64,879	94.1	0.01	0.00	-0.01	0.02	-0.01	0.01	0.00	-0.09	-0.06	0.02	0.08	-0.06	0.01	0.04	-0.00	0.00	0.04	-0.01	-0.00	0.00	-0.02	-0.01	-0.02	0.09	-0.07	0.19	-0.12	0.10
SGP	38,924	93.5	-0.04	0.00	0.02	-0.18	-0.04	0.02	0.02	-0.06	-0.01	0.01	-0.06	-0.06	0.02	-0.09	0.03	-0.04	-0.13	0.02	0.00	0.01	-0.05	0.07	-0.07	0.06	-0.05	-0.01	-0.12	0.05
IRL	48,114	212.5	0.01	-0.00	-0.01	0.08	-0.01	-0.04	0.03	-0.07	0.06	-0.02	0.03	0.10	0.04	0.08	0.06	-0.05	0.02	0.03	-0.00	0.00	0.06	-0.08	-0.04	0.04	-0.03	-0.07	-0.05	-0.02
GRC	38,452	37.2	0.15	0.01	0.04	0.04	-0.13	0.12	-0.18	0.05	0.04	0.11	0.00	0.01	-0.10	0.06	0.09	-0.08	0.02	0.15	-0.00	0.01	-0.05	0.12	-0.07	0.20	-0.12	0.35	0.01	0.24
POL	33,372	18.1	-0.08	-0.00	-0.02	-0.12	0.02	0.02	0.01	-0.01	0.11	0.01	-0.00	-0.06	-0.05	-0.09	-0.00	-0.07	-0.08	-0.01	0.00	-0.00	0.03	0.02	0.02	0.02	-0.01	-0.21	0.12	-0.06
CZE	20,190	68.1	0.47	0.00	-0.04	-0.02	-0.09	0.07	-0.07	-0.02	0.08	0.05	0.02	-0.04	0.03	0.11	-0.02	0.02	0.05	-0.01	-0.00	-0.02	0.04	-0.04	-0.03	0.02	0.76	-0.04	0.04	
CHL	18,894	6.7	-0.15	0.01	0.02	-0.19	-0.04	0.03	-0.01	0.06	0.01	-0.01	-0.07	-0.05	-0.02	-0.19	-0.01	-0.00	-0.10	-0.10	0.00	0.01	0.04	0.09	-0.19	0.11	-0.36	-0.05	-0.01	
IRN	15,516	2.3	-0.05	0.01	-0.05	0.13	-0.10	-0.01	0.03	-0.29	-0.24	-0.03	0.00	0.05	0.06	0.10	0.08	-0.07	-0.13	-0.17	0.16	-0.11	-0.01	0.25						
RUS	19,163	62.6	0.06	-0.01	-0.02	-0.01	0.04	-0.02	0.11	-0.02	0.08	-0.08	-0.03	0.03	-0.00	0.01	0.03	-0.01	-0.07	0.04	-0.00	-0.01	0.15	-0.07	0.06	0.31	-0.02	0.05	-0.03	-0.02
ROU	16,342	27.6	-0.13	-0.01	0.00	-0.16	0.04	-0.02	-0.06	-0.00	0.00	0.02	-0.07	-0.05	-0.00	-0.06	-0.06	-0.03	-0.10	0.02	0.00	-0.01	0.08	-0.01	0.05	-0.02	-0.01	-0.19	0.02	-0.09
HRV	22,399	4.2	0.04	-0.01	-0.02	0.03	0.05	-0.01	0.10	-0.06	0.02	-0.04	0.09	0.07	0.00	-0.11	-0.03	0.02	0.02	0.00	0.02	0.06	0.10	-0.21	0.13	0.11	0.03	-0.26	0.00	
MYS	14,706	165.5	0.07	-0.00	0.05	-0.01	0.02	0.07	-0.00	-0.03	-0.10	0.01	-0.07	0.02	-0.02	-0.01	-0.01	-0.00	-0.01	0.03	0.00	-0.02	-0.01	0.01	0.21	-0.13	0.03	-0.03	-0.60	0.50
HUN	27,671	465.1	-0.15	0.02	0.01	-0.13	-0.15	0.06	-0.02	0.10	0.04	0.04	-0.04	0.05	-0.07	-0.14	0.12	-0.18	-0.13	0.00	-0.00	-0.03	0.07	0.05	0.20	-0.12	-0.15	-0.08	-0.02	
IND	14,457	2.9	0.02	-0.00	0.05	0.00	0.01	0.06	-0.09	-0.00	0.15	0.09	-0.22	-0.11	-0.05	0.02	-0.04	0.11	0.02	0.01	0.00	0.01	-0.04	-0.11	-0.03	-0.07	-0.24	-0.12	0.05	
MEX	16,471	14.8	0.01	-0.00	0.07	-0.01	0.11	0.12	-0.10	-0.20	-0.13	0.07	-0.08	-0.09	-0.08	0.01	0.05	-0.07	0.00	0.01	-0.00	-0.01	0.04	-0.04	0.14	0.18	-0.10	0.61	1.54	-1.51
SVN	9,343	7.0	0.11	-0.00	0.05	-0.07	-0.00	0.05	-0.23	0.03	0.08	0.13	-0.01	-0.33	-0.09	-0.05	0.04	0.03	-0.06	0.02	-0.00	-0.01	0.03	-0.02	0.10	-0.08	0.09	0.35	-0.03	-0.33
THA	13,510	76.2	-0.11	-0.01	0.06	-0.15	0.26	0.04	0.18	-0.17	-0.14	-0.04	-0.03	0.02	0.02	-0.13	-0.10	-0.02	-0.12	-0.09	-0.00	-0.01	0.02	-0.04	0.05	0.09	-0.08	-0.07	-0.52	-0.20
ARG	8,886	10.5	0.01	0.01	0.03	0.10	-0.06	0.02	0.07	0.10	0.13	-0.07	-0.09	-0.12	0.07	0.07	-0.02	0.08	-0.03	-0.00	-0.01	-0.16	0.18	0.12	-0.05	-0.02	0.12	0.02	-0.08	
SRB	8,739	6.8	0.03	-0.00	0.02	-0.00	0.06	0.04	-0.01	0.05	-0.04	0.02	0.01	0.01	0.02	-0.26	0.29	-0.01	0.12	0.00	0.00	-0.06	-0.00	0.01	-0.01	-0.13	-0.18	-0.46	0.20	
LTU	8,058	21.9	-0.20	0.01	-0.09	-0.20	-0.07	0.09	-0.29	-0.06	0.03	0.21	-0.08	-0.17	0.01	-0.15	0.11	-0.09	-0.15	0.02	0.00	0.00	0.09	0.04	-0.05	-0.08	0.05	-0.05	-0.51	0.42
EST	12,195	47.1	0.06	-0.00	-0.04	0.07	0.00	-0.09	-0.22	0.12	0.26	0.08	-0.07	-0.23	0.24	-0.01	0.01	0.00	-0.01	0.01	-0.19	0.10	-0.41	0.26	-0.03	0.22	-0.33			
SVK	7,835	104.0	-0.13	0.01	-0.09	0.24	-0.07	-0.24	0.02	-0.01	-0.14	-0.10	0.52	0.16	0.16	0.31	-0.07	0.08	0.21	0.03	-0.00	0.00	-0.05	-0.02	-0.04	-0.19	0.10	0.24	-0.05	0.00
CYP	5,278	13.5	0.39	-0.01	-0.04	0.15	-0.01	-0.00	0.03	-0.23	-0.18	-0.02	0.16	-0.02	0.05	0.13	-0.03	-0.09	0.12	0.02	-0.01	0.01	-0.02	0.01	-0.11	0.13	-0.13	0.78	0.07	0.07
SAU	10,191	134.1	0.05	-0.01	0.04	-0.11	0.03	0.04	0.06	-0.17	-0.08	0.02	-0.14	0.10	-0.03	-0.06	-0.02	-0.09	-0.11	0.03	0.00	-0.00	0.01	0.02	-0.02	0.10	-0.05	-0.11	-0.03	0.24
COL	5,372	1.0	0.13	0.00	-0.06	0.13	-0.04	-0.14	0.02	-0.04	-0.13	-0.07	0.22	0.13	0.14	0.15	-0.02	0.09	0.12	0.07	0.00	0.00	-0.08	-0.08	-0.03	-0.34	0.27	-0.72	0.97	-0.48

Table S9: Relative importance differences of the categories for countries in Biomedical & Health sciences for deltas 3→10

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	93,959,336	4437.1	-0.00	0.01	-0.01	0.00	-0.01	-0.01	-0.00	0.00	-0.00	-0.01	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.01	-0.00	0.01	0.01	0.00	0.00	-0.00	-0.00	0.00	0.00	0.00	0.00
USA	33,928,604	4104.3	-0.01	-0.00	0.02	-0.01	0.02	0.02	-0.03	0.05	-0.04	0.01	-0.07	-0.05	-0.03	-0.06	0.01	0.00	-0.01	-0.08	0.00	-0.00	-0.02	-0.01	0.01	-0.11	0.06	-0.09	-0.02	-0.04
GBR	9,921,341	2156.5	-0.00	-0.00	-0.01	0.07	-0.00	-0.03	0.06	-0.08	-0.07	-0.03	0.09	0.08	0.05	0.08	0.02	-0.01	0.06	0.02	-0.00	-0.00	-0.03	0.01	-0.01	0.02	-0.01	0.05	-0.02	0.05
CHN	10,224,002	472.0	0.00	-0.00	0.02	-0.03	0.00	0.02	-0.02	0.09	-0.01	0.01	-0.02	-0.02	-0.00	-0.03	0.03	-0.01	-0.04	0.02	0.00	0.00	-0.01	0.02	-0.03	0.02	0.01	-0.02	0.02	0.04
DEU	9,683,847	3193.8	-0.03	-0.00	-0.01	0.03	-0.02	-0.02	0.02	0.08	-0.05	-0.02	-0.02	0.00	-0.01	-0.02	-0.01	0.02	0.04	-0.06	0.00	-0.00	-0.05	0.02	0.01	-0.09	0.04	-0.07	0.05	-0.05
JPN	7,392,211	4806.1	-0.02	0.00	-0.00	0.05	-0.01	-0.02	0.01	0.05	-0.11	-0.03	-0.01	0.00	0.01	0.01	0.05	-0.03	0.05	-0.03	0.00	0.01	-0.02	-0.02	-0.07	-0.06	-0.02	-0.04	0.03	-0.13
ITA	8,219,690	4835.2	-0.01	0.00	-0.01	-0.02	-0.01	-0.00	0.03	0.05	-0.05	-0.01	-0.02	0.00	-0.01	-0.03	0.02	-0.00	-0.00	-0.05	0.00	0.00	0.00	-0.02	-0.01	-0.02	0.01	-0.02	0.04	-0.08
CAN	5,521,942	1823.5	-0.00	0.00	0.02	-0.10	-0.02	0.04	-0.02	-0.04	0.02	0.03	-0.13	-0.11	-0.05	-0.12	-0.02	0.00	-0.09	-0.03	0.00	0.00	0.01	0.01	-0.02	-0.00	-0.01	-0.04	0.03	-0.02
FRA	7,210,391	2846.2	-0.01	-0.00	-0.02	0.03	-0.00	-0.02	-0.00	0.05	-0.06	-0.00	-0.02	-0.04	-0.04	-0.03	-0.03	0.03	0.05	-0.07	0.00	0.00	-0.03	-0.01	-0.01	-0.05	0.01	-0.05	0.03	-0.03
AUS	3,699,021	1808.5	-0.01	0.00	-0.00	0.05	0.01	-0.01	0.01	-0.03	-0.09	-0.02	0.02	0.02	0.06	-0.05	0.04	0.06	0.01	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.01	-0.04	0.01	0.06
NLD	4,974,288	5262.8	-0.00	-0.00	-0.00	0.04	-0.02	-0.00	0.01	-0.06	-0.05	-0.02	-0.01	-0.02	0.04	0.05	-0.09	0.07	0.04	0.01	0.00	0.00	0.01	-0.06	-0.05	-0.08	0.02	-0.05	-0.01	-0.02
ESP	4,703,093	2077.8	0.02	-0.00	-0.01	-0.01	0.01	-0.01	0.08	-0.04	-0.05	-0.01	0.02	0.04	0.00	-0.00	0.01	0.03	-0.03	-0.00	0.00	-0.00	-0.03	0.01	-0.01	0.04	-0.02	0.01	0.00	-0.01
KOR	3,806,842	10513.5	0.02	0.00	-0.02	0.03	-0.00	-0.03	0.02	0.05	-0.05	-0.03	0.00	0.02	0.01	-0.01	0.03	-0.02	0.03	-0.10	-0.00	-0.01	0.04	-0.12	0.13	-0.12	0.07	-0.05	-0.10	-0.05
BRA	2,970,780	1045.7	-0.02	0.00	0.00	0.02	-0.03	-0.00	-0.02	0.20	0.03	-0.02	-0.04	-0.02	-0.01	-0.02	-0.06	0.08	0.03	-0.06	0.00	0.00	-0.01	-0.02	-0.02	-0.06	0.02	-0.10	0.04	-0.16
SWE	2,549,442	2570.7	-0.02	-0.00	-0.01	-0.02	0.03	-0.00	0.03	-0.05	-0.06	0.00	0.02	0.02	0.02	0.05	-0.09	0.06	0.00	0.03	-0.00	-0.01	-0.00	-0.00	0.03	-0.00	0.02	0.08	0.05	-0.17
CHE	2,648,795	1578.0	-0.02	0.01	-0.01	-0.00	-0.05	-0.01	0.10	-0.01	-0.01	-0.02	0.03	0.05	0.04	-0.02	0.00	0.01	-0.01	-0.01	-0.00	-0.00	0.02	-0.11	-0.03	-0.02	0.04	-0.02	-0.01	
TUR	1,436,652	1419.4	-0.02	0.01	-0.02	0.03	-0.01	-0.03	0.01	0.16	-0.00	-0.00	0.01	0.03	0.01	0.13	-0.07	0.03	0.02	0.00	0.01	-0.03	0.00	-0.03	-0.07	0.01	-0.00	0.02	-0.13	
TWN	1,453,522	869.9	0.00	-0.01	0.04	-0.00	0.05	0.06	-0.03	0.07	0.01	0.02	-0.11	-0.11	-0.01	-0.03	0.02	-0.01	-0.03	-0.02	0.00	-0.00	-0.03	0.02	-0.01	-0.01	0.04	-0.03	0.08	-0.02
DNK	1,725,540	2299.7	-0.01	-0.00	-0.03	0.16	0.00	-0.06	0.07	0.13	-0.12	-0.05	0.08	0.16	-0.02	-0.01	0.09	-0.05	0.21	-0.06	0.00	0.00	-0.06	0.02	-0.05	0.04	-0.03	0.02	-0.13	0.28
BEL	1,942,386	1216.9	0.01	0.00	-0.01	0.03	-0.00	-0.01	-0.02	-0.07	-0.02	0.02	0.02	0.02	0.06	-0.05	0.04	0.00	0.03	0.03	0.00	-0.01	0.02	0.00	-0.05	0.05	-0.01	0.06	-0.06	
POL	1,373,790	1500.5	0.01	-0.00	0.02	-0.01	0.03	0.02	-0.02	-0.05	-0.05	0.03	-0.04	-0.08	-0.04	-0.01	-0.02	0.02	-0.01	0.01	-0.00	-0.00	-0.04	0.02	0.02	0.02	-0.01	0.07	0.07	-0.01
IND	747,969	846.7	0.03	-0.00	0.02	0.01	0.02	-0.00	-0.04	-0.17	-0.12	-0.00	-0.01	-0.02	0.00	0.01	-0.00	-0.03	0.01	0.04	-0.00	-0.01	-0.04	0.03	0.09	0.05	-0.02	0.07	-0.16	0.21
AUT	1,675,734	2332.8	-0.02	0.00	0.01	-0.06	-0.01	0.01	-0.05	-0.05	0.02	0.02	-0.03	-0.04	-0.02	-0.06	-0.04	0.01	-0.05	-0.00	0.00	0.01	0.00	0.04	0.01	-0.00	-0.02	-0.01	0.03	
ISR	1,130,866	1155.2	-0.02	0.01	-0.05	0.00	-0.06	-0.00	-0.07	0.02	0.08	0.03	-0.00	-0.06	0.01	-0.03	0.06	0.01	0.01	-0.04	0.00	0.00	0.06	-0.02	-0.02	0.04	0.03	0.05	0.07	-0.04
GRC	1,098,046	12780.9	-0.00	-0.00	-0.01	0.02	0.02	-0.01	-0.05	0.04	-0.05	-0.00	0.00	-0.01	0.01	0.02	-0.09	0.07	0.02	0.00	0.00	-0.00	0.01	-0.03	-0.02	0.02	-0.01	-0.06	-0.08	0.14
NOR	1,088,074	1431.8	0.01	0.00	0.01	0.01	-0.02	0.00	0.02	-0.00	0.04	-0.01	-0.04	0.03	0.01	0.02	0.09	-0.05	0.01	0.02	0.00	-0.03	0.02	-0.01	0.07	-0.04	0.05	-0.07	0.14	
IRN	496,041	1064.9	-0.01	-0.00	0.01	0.00	-0.01	0.01	-0.10	-0.14	0.13	0.03	0.01	-0.05	-0.03	0.02	0.05	-0.01	-0.02	0.05	-0.00	-0.00	0.03	-0.02	0.01	-0.00	0.04	-0.01	0.10	-0.01
FIN	1,182,799	3132.2	0.02	-0.01	-0.01	-0.05	0.04	-0.03	0.10	0.13	-0.08	-0.03	0.07	0.10	-0.02	-0.02	-0.00	-0.00	-0.02	-0.00	-0.00	-0.01	-0.01	-0.01	0.05	-0.02	-0.02	0.03	-0.06	0.10
IRL	773,394	822.6	0.05	0.00	0.00	0.04	-0.04	-0.00	0.04	-0.10	-0.03	-0.02	0.01	-0.01	0.04	0.05	-0.07	0.04	0.03	0.03	0.00	0.00	-0.03	-0.04	-0.08	0.03	-0.04	-0.03	-0.00	
PRT	720,738	841.9	-0.01	0.01	-0.02	0.04	-0.04	-0.03	0.05	0.12	-0.05	-0.03	0.02	0.05	0.03	0.03	0.05	-0.03	0.03	0.01	0.00	-0.02	0.00	-0.04	0.03	-0.04	0.03	-0.10	0.07	
CZE	896,872	1343.6	-0.02	0.00	-0.01	-0.04	-0.02	0.00	-0.06	0.07	0.02	0.02	-0.03	-0.03	-0.04	-0.07	-0.04	0.04	-0.03	-0.09	0.00	0.00	0.00	-0.03	0.02	0.04	-0.01	-0.13	0.08	-0.07
RUS	484,802	454.9	0.03	0.00	-0.01	0.01	-0.02	0.01	-0.08	-0.06	0.04	0.02	-0.03	-0.00	-0.01	0.03	0.04	0.01	0.00	0.01	-0.00	0.00	-0.03	0.08	-0.04	0.05	-0.01	0.05	-0.08	-0.03
SGP	620,466	4313.9	-0.12	-0.00	-0.00	-0.00	-0.02	-0.01	0.09	0.04	-0.10	-0.01	0.06	0.21	0.07	0.13	0.04	-0.05	0.03	0.04	0.00	0.00	0.07	-0.01	-0.04	0.07	-0.07	-0.13	-0.03	0.05
ZAF	453,672	1455.5	-0.05	-0.00	-0.00	0.04	0.02	-0.00	0.01	-0.07	-0.06	-0.00	0.10	0.01	0.05	0.09	-0.00	0.00	0.03	0.03	-0.00	-0.00	-0.03	0.03	-0.01	0.05	-0.08	-0.01	0.05	0.08
NZL	417,422	693.5	0.06	-0.00	0.02	-0.08	-0.00	0.05	0.02	-0.09	-0.06	0.04	-0.08	-0.10	-0.03	-0.10	-0.02	0.02	-0.12	0.03	-0.00	0.00	0.04	0.02	-0.04	0.06	0.03	0.00	0.10	0.16
HUN	653,117	2135.9	0.01	-0.01	0.02	-0.06	0.09	0.01	0.18	-0.06	-0.02	-0.01	0.03	0.01	-0.01	-0.07	-0.01	-0.02	-0.06	0.00	-0.00	0.00	0.01	0.02	0.02	0.00	-0.03	-0.01	0.02	
THA	431,396	8229.8	0.01	-0.01	-0.00	0.11	0.06	-0.01	0.01	-0.07	-0.12	-0.01	0.18	0.06	0.07	0.15	0.05	-0.02	0.04	0.05	-0.00	-0.00	-0.07	0.02	0.03	0.04	-0.01	0.17	-0.03	0.05
EGY	318,860	131.0	0.07	0.00	-0.01	-0.07	-0.02	0.00	0.14	-0.05	0.30	-0.02	0.04	0.06	0.04	-0.03	-0.01	-0.02	-0.07	0.03	-0.00	0.01	0.06	-0.01	-0.06	0.03	-0.05	0.09	-0.02	0.04
MEX	238,621	87.4	0.03	0.00	0.03	-0.07	-0.02	0.05	-0.15	0.09	0.29	0.05	-0.14	-0.07	-0.12	-0.08	-0.02	-0.02	-0.05	-0.03	-0.00	0.00	0.01	-0.01	-0.02	-0.03	-0.01	0.06	-0.02	-0.07
MYS	197,485	209.1	0.04	-0.00	-0.00	-0.04	-0.01	-0.01	0.05	0.15	0.22	-0.02	-0.02	0.03	0.02	-0.02	0.01	-0.06	-0.04	0.04	-0.00	-0.00	0.09	-0.01	0.02	0.01	-0.03	0.18	-0.06	0.03
SAU	322,965	469.8	0.01	-0.01	0.05	-0.14	0.10	0.08	-0.08	-0.17	-0.01	0.04	-0.11	-0.09	-0.08	-0.15	-0.01	-0.04	-0.16	0.03	0.00	-0.01	0.05	0.01	0.09	0.05	-0.00	-0.02	0.05	0.02
CHL	288,859	447.6	-0.09	0.00	0.00	-0.06	-0.01	0.02	-0.11	-0.06	0.05	0.01	-0.09	-0.10	-0.06	-0.10	-0.10	-0.07	-0.03	0.01	0.00	-0.00	0.10	-0.07	0.03	-0.08	0.06	-0.19	0.16	-0.17
ROU	234,054	366.4	0.06	0.01	-0.00	0.00	-0.03	0.00	-0.05	0.01	0.02	0.01	-0.03	-0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.00	-0.00	0.00	0.03	-0.02	-0.02	0.01	0.01	0.02	-0.02	0.07
ARG	195,311	101.0	0.04	0.00	-0.01	0.05	0.00	-0.03	-0.10	0.10	0.22	0.01	0.07	0.04	0.03	0.05	0.05	-0.00	0.04	0.03	-0.00	-0.00	0.01	-0.03	0.05	-0.02	-0.01	0.29	-0.05	0.06
SRB	196,159	434.3	0.03	-0.00	0.02	0.02	0.06	0.00	-0.03	0.12	0.30	-0.01	0.02	-0.02	-0.00	0.01	-0.05	0.05	0.02	-0.02	0.00	-0.01	-0.11	0.08	0.15	0.06	-0.00	-0.12	0.03	-0.06
HRV	208,904	391.2	-0.05	-0.00	0.03	-0.08	0.05	0.04	0.05	-0.17	-0.17	-0.00	-0.03	0.00	-0.02	-0.09	0.03	-0.04	-0.09	-0.00	0.00	-0.00	-0.02	0.02	0.04	0.12	-0.03	-0.13	0.09	0.01
SVN	165,229	283.5	0.06	-0.00	-0.03	-0.01	-0.00	0.01	-0.20	-0.04	0.00	0.08	-0.15	-0.12	-0.10	-0.01	-0.01	0.05	-0.01	-0.01	-0.00	0.00	0.00	-0.01	-0.05	-0.01	-0.10	0.03	-0.07	
PAK	124,525	742.6	-0.03	-0.00	-0.01	0.00	0.00	-0.02	0.22	0.04	0.15	-0.05	-0.02	-0.01	0.01	0.08	-0.04	0.03	0.03	0.03	0.00	-0.00	0.11	-0.09	-0.00	-0.02	-0.06	-0.02	0.01	-0.21
SVK	163,795	914.5	0.10	-0.00	-0.02	0.27	0.00	-0.07	0.06	-0.16	-0.18	-0.04	0.35	0.16	0.13	0.32	0.04	0.02	0.19	0.06	-0.00	0.00	-0.06	0.01	-0.04	0.02	0.02	0.37	-0.04	0.10
LTU	91,789	109.7	-0.03	0.01	-0.01	-0.07	-0.06	0.01	-0.17	-0.01	-0.01	0.07	-0.05	-0.05	-0.05	-0.07	-0.02	-0.02	-0.07	0.03	-0.00	0.00	0.04	-0.02	-0.01	0.07	-0.03	0.02	-0.08	0.03
NGA	54,844	88.7	-0.08	0.01	0.01	-0.13	-0.05	0.00	0.02	0.00	0.01	0.01	0.10	0.09	0.06	-0.12	-0.00	0.01	-0.11	0.02	0.00	0.00	-0.02	0.07	-0.02	0.07	-0.05	-0.16	0.04	-0.12

Table S10: Relative importance differences of the categories for countries in Physical sciences & Engineering for deltas 3→10

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	35,167,505	1151.0	-0.00	0.01	-0.00	0.00	-0.01	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.01	-0.00	0.00	0.01	0.00	-0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00
CHN	10,363,608	657.9	0.02	-0.00	0.02	-0.02	-0.03	-0.00	-0.03	0.16	0.08	0.01	-0.01	-0.01	-0.02	-0.04	0.02	-0.01	-0.02	-0.03	0.00	0.00	-0.01	0.01	-0.02	-0.02	0.01	-0.00	0.04	-0.03
USA	8,586,374	954.9	0.01	0.00	-0.00	-0.00	-0.03	0.01	0.00	-0.03	-0.03	0.00	-0.02	-0.01	-0.00	-0.01	-0.01	0.02	0.01	-0.01	0.00	0.00	-0.00	-0.00	-0.04	0.00	-0.02	-0.02	-0.04	0.02
DEU	4,283,016	1327.2	-0.02	0.00	-0.01	0.02	-0.03	-0.01	-0.02	-0.01	0.04	-0.00	-0.04	-0.02	-0.00	0.04	0.01	-0.01	0.04	0.00	0.00	-0.00	-0.01	-0.00	-0.01	-0.02	-0.00	0.02	0.05	-0.07
JPN	2,968,967	1410.3	0.02	0.00	-0.01	0.07	-0.02	-0.05	0.05	0.08	-0.06	-0.06	0.01	0.01	0.03	0.04	-0.03	0.05	0.07	-0.02	-0.00	0.00	-0.01	-0.04	-0.03	-0.05	-0.00	0.09	0.07	-0.07
GBR	3,088,381	1155.6	0.01	-0.00	-0.01	0.05	0.02	-0.03	-0.04	-0.05	-0.01	0.01	0.03	0.02	0.02	0.06	-0.01	0.02	0.05	0.01	0.00	-0.00	-0.00	-0.02	0.04	0.01	0.01	0.01	0.01	-0.02
FRA	3,379,047	609.3	0.01	0.00	-0.02	0.02	-0.02	-0.02	-0.01	0.00	0.03	0.01	-0.02	-0.02	0.03	0.01	-0.01	0.03	0.03	0.01	-0.00	-0.00	0.00	0.01	-0.02	-0.00	-0.06	0.02	0.02	-0.03
KOR	1,852,837	508.6	-0.03	-0.00	-0.01	0.02	-0.04	-0.02	0.04	0.08	0.05	-0.03	-0.01	0.03	-0.00	-0.02	0.03	-0.03	0.02	-0.03	-0.00	0.00	0.04	-0.06	-0.05	-0.03	-0.02	0.12	-0.04	-0.01
IND	967,436	496.7	-0.13	0.01	0.05	0.01	-0.07	0.10	0.02	-0.09	0.02	-0.02	-0.12	-0.05	-0.07	-0.00	0.01	0.02	0.00	-0.00	0.00	0.00	0.09	-0.01	-0.01	-0.03	0.01	0.05	-0.03	-0.00
ITA	2,342,357	944.8	0.02	-0.00	-0.01	0.00	0.01	-0.01	-0.06	-0.02	-0.02	0.03	-0.03	0.03	0.00	0.01	0.05	-0.01	0.00	0.01	0.00	0.00	0.01	-0.00	0.01	0.08	-0.01	0.03	0.09	-0.04
ESP	1,852,018	757.4	0.06	-0.00	-0.01	-0.01	-0.00	-0.00	-0.07	0.05	0.01	0.02	-0.01	-0.02	-0.02	-0.01	-0.01	0.02	-0.01	-0.00	0.00	-0.00	-0.01	-0.01	0.04	0.01	0.01	0.04	0.07	0.01
RUS	1,529,642	1073.6	0.03	-0.00	0.03	-0.03	0.03	0.04	-0.01	-0.08	-0.04	0.01	-0.03	-0.04	-0.01	-0.02	0.02	-0.01	-0.04	0.02	-0.00	-0.00	-0.01	-0.03	0.02	0.00	0.00	0.20	-0.00	0.05
CAN	1,156,385	447.0	0.03	0.00	-0.02	-0.00	-0.01	-0.03	0.07	-0.01	0.05	-0.00	0.03	-0.00	0.01	0.01	-0.03	0.02	0.01	0.01	0.00	-0.00	0.00	0.01	0.00	0.00	-0.01	0.02	0.03	0.02
AUS	1,055,964	862.1	-0.02	0.00	-0.01	-0.04	-0.02	0.02	0.09	-0.07	-0.02	-0.01	-0.02	0.03	-0.02	-0.05	-0.04	0.02	-0.03	-0.03	0.00	0.00	0.05	-0.04	-0.02	-0.04	0.05	-0.07	0.03	-0.05
IRN	345,946	907.5	0.07	-0.00	0.04	-0.07	0.05	0.09	-0.05	0.13	0.14	0.04	-0.06	-0.06	-0.07	-0.11	-0.01	0.05	-0.09	-0.09	-0.00	-0.01	0.03	0.05	0.07	0.03	-0.03	0.04	0.10	-0.09
TWN	818,100	288.7	0.01	0.01	-0.04	0.03	-0.10	-0.08	-0.14	0.16	0.07	0.04	0.01	0.03	-0.06	-0.03	-0.00	0.04	0.05	-0.09	0.00	-0.00	-0.01	-0.06	-0.02	-0.00	0.01	0.01	-0.06	0.01
BRA	812,346	419.7	-0.06	-0.01	-0.01	-0.00	-0.07	0.06	0.00	0.19	-0.01	-0.03	-0.12	-0.06	-0.08	-0.06	-0.01	0.03	0.02	-0.09	0.00	0.00	-0.04	0.02	-0.03	0.01	-0.02	0.01	0.06	-0.08
POL	846,089	1659.5	0.01	-0.00	-0.01	0.00	0.08	-0.02	-0.00	-0.03	-0.05	-0.01	0.03	0.05	0.03	0.03	0.03	-0.00	-0.00	0.02	0.00	-0.00	-0.01	0.00	0.05	0.01	0.00	0.07	0.01	-0.06
CHE	1,028,878	1208.4	0.01	-0.00	-0.01	0.08	-0.01	-0.02	0.03	-0.10	-0.07	-0.03	0.07	-0.01	0.04	0.09	-0.05	0.06	0.06	0.02	0.00	-0.00	0.01	-0.06	0.04	-0.11	0.02	-0.06	0.05	0.01
NLD	953,715	1202.4	-0.01	0.00	0.00	-0.04	-0.02	-0.03	0.03	-0.00	0.06	0.00	0.01	0.01	0.02	-0.03	-0.01	0.01	-0.01	0.02	-0.00	-0.00	-0.00	0.02	-0.00	0.01	-0.02	-0.06	0.02	-0.03
TUR	308,101	434.8	-0.06	-0.00	-0.01	-0.17	0.01	-0.01	0.05	0.17	0.15	0.01	-0.00	0.03	-0.03	-0.12	-0.07	-0.01	-0.11	-0.00	-0.00	0.00	0.07	-0.02	-0.01	-0.09	-0.01	-0.18	-0.07	-0.08
SWE	752,009	680.1	-0.04	0.00	-0.01	0.03	-0.01	-0.03	0.00	-0.02	-0.02	-0.00	0.05	0.04	0.03	0.05	0.02	0.00	0.03	0.02	-0.00	0.00	-0.03	0.02	-0.03	0.01	-0.02	0.04	-0.06	0.05
BEL	742,621	1116.7	0.02	-0.00	-0.01	0.05	0.03	-0.03	-0.01	-0.03	0.02	-0.00	0.05	0.01	0.05	-0.01	-0.00	-0.00	0.04	0.02	0.00	-0.00	-0.02	-0.01	0.04	-0.03	-0.02	-0.01	-0.05	0.01
SGP	459,453	514.9	-0.02	-0.00	0.01	-0.03	-0.01	0.02	0.00	-0.02	-0.01	-0.03	-0.03	-0.04	-0.00	-0.00	-0.12	0.08	-0.02	0.01	0.00	-0.00	0.03	-0.02	0.00	-0.12	0.05	-0.09	-0.02	-0.09
PRT	473,214	1244.1	0.00	-0.00	-0.01	-0.02	0.03	0.01	0.01	-0.03	-0.10	-0.01	-0.00	-0.01	-0.00	0.00	-0.00	-0.03	-0.01	-0.00	0.00	-0.00	-0.03	0.07	-0.06	0.02	-0.04	-0.01	0.04	0.06
CZE	503,947	1113.1	0.01	0.00	-0.05	0.11	-0.03	-0.08	0.02	-0.10	-0.15	-0.05	0.06	0.12	0.06	0.10	0.12	-0.05	0.11	0.02	0.00	0.01	-0.06	0.02	-0.12	0.18	-0.08	0.03	-0.04	0.04
AUT	472,246	520.0	0.03	0.00	-0.02	0.01	-0.01	-0.04	-0.08	0.03	0.11	0.02	0.03	-0.01	-0.02	-0.00	0.04	-0.02	0.01	-0.01	0.00	-0.00	-0.02	-0.00	0.05	0.08	-0.02	-0.01	0.00	0.02
MYS	210,191	4804.1	-0.03	-0.01	0.05	-0.12	-0.00	0.05	-0.03	-0.03	0.03	0.03	-0.06	-0.02	-0.01	-0.10	-0.03	-0.00	-0.12	0.02	0.00	-0.00	0.15	-0.05	0.00	0.00	0.04	-0.20	-0.09	0.00
ROU	301,946	448.0	-0.00	-0.00	0.01	-0.06	0.02	0.06	-0.01	0.10	-0.04	0.03	-0.05	-0.05	-0.00	-0.05	0.07	-0.06	-0.06	0.02	0.00	-0.00	-0.03	0.07	-0.03	-0.00	0.02	0.02	0.04	0.01
DNK	456,882	511.4	0.02	-0.00	0.03	0.07	0.06	0.06	-0.03	-0.28	-0.05	0.03	-0.07	0.02	0.06	0.08	-0.01	0.03	0.05	0.05	0.00	0.00	0.03	-0.01	-0.03	0.05	0.05	-0.03	0.15	0.12
ISR	311,563	433.2	-0.00	0.00	0.01	0.05	-0.02	-0.00	-0.01	-0.17	-0.06	0.00	0.03	0.01	0.02	0.07	0.02	-0.01	0.06	0.01	0.00	0.00	0.03	-0.02	-0.02	0.02	-0.02	-0.03	0.03	-0.08
FIN	415,659	1078.7	-0.01	-0.00	0.01	-0.01	0.06	0.01	-0.06	-0.04	-0.01	-0.00	-0.06	-0.03	-0.00	0.01	-0.01	-0.02	-0.00	0.02	0.00	-0.01	-0.01	-0.02	0.18	-0.06	0.06	0.01	-0.00	-0.01
UKR	309,094	542.9	-0.04	-0.00	0.01	-0.08	0.06	-0.00	0.00	-0.03	-0.04	0.03	0.06	0.02	0.01	-0.07	-0.03	0.03	-0.09	-0.03	-0.00	0.01	0.00	-0.02	0.02	0.02	0.03	0.05	0.10	-0.06
GRC	290,229	486.1	0.06	0.00	0.01	0.00	-0.03	-0.00	0.04	0.07	-0.01	0.01	0.01	0.01	0.00	0.00	-0.01	0.02	-0.00	0.01	0.00	0.01	-0.02	-0.01	-0.08	0.03	-0.03	0.32	0.04	0.03
MEX	225,948	159.6	-0.03	0.00	-0.03	0.02	-0.01	-0.00	-0.06	0.06	0.07	0.02	-0.02	-0.06	-0.04	0.02	-0.02	0.03	0.03	-0.01	-0.00	-0.00	0.02	0.00	-0.01	0.02	0.04	0.02	0.08	-0.08
SAU	280,647	1612.9	-0.07	-0.01	0.01	-0.03	0.02	0.01	0.05	-0.03	0.11	-0.00	-0.02	0.08	0.02	-0.02	-0.02	-0.07	-0.06	0.02	-0.00	-0.00	0.09	0.00	0.00	0.07	-0.05	-0.18	-0.11	0.03
EGY	129,202	456.1	0.09	0.00	-0.01	-0.00	-0.02	-0.01	0.06	0.01	0.16	-0.01	-0.01	0.12	0.03	0.03	0.05	-0.03	-0.01	0.03	-0.00	0.00	0.05	0.00	-0.05	0.08	-0.09	0.10	-0.05	0.04
ZAF	198,602	650.9	-0.05	-0.00	0.03	-0.10	0.04	0.08	-0.12	-0.09	0.01	0.07	-0.08	-0.06	-0.07	-0.12	-0.01	-0.01	-0.13	0.02	-0.00	-0.01	0.02	0.07	0.06	0.04	0.00	-0.03	-0.14	0.00
HUN	254,035	896.1	0.09	0.00	0.01	0.04	-0.05	0.00	0.04	-0.14	-0.07	0.01	0.07	0.03	0.06	0.04	-0.06	-0.02	0.02	0.02	-0.00	0.01	-0.05	0.02	-0.13	-0.02	-0.01	0.27	0.08	0.09
NOR	180,363	243.5	0.04	0.00	0.00	-0.05	-0.05	0.00	-0.06	-0.04	0.00	0.04	-0.01	0.04	-0.01	-0.05	0.01	0.00	-0.06	0.01	-0.00	-0.04	0.01	-0.01	-0.04	-0.04	0.03	0.02	0.10	-0.03
IRL	211,526	258.7	0.02	0.01	-0.01	-0.01	-0.09	-0.04	0.04	-0.01	0.06	-0.03	0.04	0.01	0.02	-0.01	-0.10	0.08	-0.01	0.01	0.00	0.01	0.01	-0.03	-0.08	-0.08	0.05	-0.11	0.04	-0.08
THA	121,672	712.5	0.22	-0.01	-0.01	0.16	0.04	-0.07	0.09	0.66	-0.09	-0.17	-0.01	-0.05	-0.02	-0.02	0.08	-0.09	0.16	-0.18	0.00	-0.02	-0.27	0.14	0.30	-0.19	0.09	-0.26	-0.10	0.00
SRB	125,438	352.9	-0.03	-0.00	0.02	0.01	0.01	0.01	-0.00	0.09	0.04	-0.01	-0.02	-0.01	-0.00	0.01	0.08	-0.04	0.01	0.01	-0.00	-0.00	-0.03	0.00	0.02	0.07	-0.02	0.03	0.01	-0.06
ARG	109,746	140.6	0.05	-0.00	0.01	-0.01	0.01	0.01	-0.06	-0.10	-0.06	0.05	0.03	-0.04	0.02	-0.02	0.01	-0.02	-0.03	0.02	-0.00	-0.06	0.02	-0.05	-0.01	0.03	0.01	0.20	-0.06	0.10
CHL	209,565	2555.5	0.03	-0.00	-0.00	0.03	0.08	-0.02	-0.02	-0.12	-0.10	0.01	0.05	0.06	0.05	0.07	0.03	-0.02	0.02	0.03	-0.00	-0.00	-0.02	0.01	0.01	0.04	-0.03	0.10	-0.09	0.07
SVN	136,800	1002.2	0.02	-0.00	0.00	-0.03	0.13	-0.00	0.12	-0.05	0.01	0.00	0.01	-0.08	0.02	-0.02	-0.05	-0.01	-0.02	-0.00	0.00	-0.00	-0.02	0.01	0.04	0.04	-0.01	-0.01	0.03	0.03
PAK	90,020	2900.6	-0.40	0.00	-0.01	0.03	-0.01	-0.01	0.02	-0.02	0.02	0.00	0.02	0.05	0.02	0.01	-0.04	-0.05	-0.01	0.01	0.00	-0.00	0.23	-0.09	-0.01	0.01	-0.00	-0.44	-0.10	0.02
SVK	145,580	432.1	-0.05	-0.00	0.00	-0.00	0.07	0.02	0.07	-0.01	-0.01	-0.02	0.08	-0.04	0.02	-0.01	-0.05	0.06	-0.01	0.01	0.00	-0.00	-0.03	-0.01	0.01	-0.04	0.04	-0.15	-0.05	-0.04
DZA	81,577	441.6	-0.04	-0.00	-0.04	0.17	0.02	-0.01	0.14	0.01	-0.19	-0.07	0.11	-0.08	0.01	0.20	0.06	-0.02	0.21	0.00	-0.00	0.00	-0.13	0.10	-0.06	0.07	-0.11	0.11	-0.04	0.10
NZL	94,194	110.2	0.13	0.00	0.02	-0.14	-0.07	0.02	-0.08	-0.10	-0.01	0.07	-0.03	-0.04	-0.04	-0.13	-0.08	0.04	-0.15	0.03	0.00	0.00	0.02	0.04	-0.00	0.03	0.03	0.05	0.02	0.10
BGR	96,685	191.8	-0.00	0.00	0.00	0.01	-0.02	0.00	-0.02	-0.09	-0.07	0.02	0.03	0.03	0.02	0.03	0.04	-0.01	-0.00	0.03	-0.00	0.01	-0.03	0.04	-0.08	0.08	-0.00	-0.11	0.09	0.18

Table S11: Relative importance differences of the categories for countries in Life & Earth sciences for deltas 3→10

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	22,557,784	368.9	-0.00	0.01	-0.00	0.01	-0.01	-0.00	-0.00	0.00	-0.00	-0.01	-0.00	-0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	-0.00	0.00	-0.00	-0.00	0.00	0.00	0.00	0.00
USA	6,996,167	265.6	0.04	0.00	-0.01	0.00	-0.03	0.04	0.05	-0.04	-0.09	0.00	-0.05	-0.03	0.01	0.04	-0.01	0.04	-0.01	0.05	-0.00	0.00	0.02	-0.00	-0.07	-0.04	0.01	0.08	0.06	0.02
CHN	4,149,832	274.1	0.00	-0.00	0.01	0.04	-0.01	-0.01	0.04	-0.03	0.03	-0.01	0.01	0.02	0.02	0.03	0.06	-0.02	0.01	0.03	0.00	-0.00	-0.00	0.04	-0.02	0.07	0.01	0.06	0.03	0.09
GBR	2,397,358	447.8	0.02	-0.01	-0.01	0.13	0.04	-0.04	-0.02	-0.07	-0.08	-0.01	0.13	0.09	0.06	0.16	0.05	-0.02	0.10	0.04	-0.00	-0.00	-0.05	0.01	0.03	0.04	-0.02	0.12	-0.04	0.08
DEU	2,334,606	214.3	-0.01	0.00	-0.01	0.04	-0.03	-0.00	-0.03	-0.08	-0.02	0.00	-0.03	0.01	0.02	0.03	0.03	-0.03	0.04	-0.00	0.00	0.00	-0.00	0.00	-0.03	-0.00	-0.00	-0.01	-0.03	0.01
BRA	1,535,282	253.8	-0.01	0.00	0.00	-0.00	-0.01	-0.03	0.08	-0.04	-0.11	-0.04	-0.00	0.05	-0.03	-0.07	-0.01	-0.02	-0.00	-0.08	0.00	-0.00	-0.02	0.01	0.04	-0.06	0.02	-0.15	-0.00	-0.06
FRA	2,016,547	210.4	0.01	-0.00	-0.01	0.01	-0.00	-0.03	-0.04	0.03	0.03	-0.00	0.05	0.04	0.02	0.02	-0.00	-0.01	0.01	0.01	-0.00	-0.00	0.02	-0.04	0.02	0.02	-0.03	0.05	-0.04	0.06
CAN	1,202,791	417.0	0.00	-0.00	-0.01	0.08	-0.03	-0.02	0.08	-0.03	-0.10	-0.02	0.04	0.08	0.06	0.11	0.06	-0.03	0.06	0.03	0.00	-0.00	-0.02	0.01	-0.03	0.04	-0.02	0.04	0.00	0.14
ESP	1,426,076	421.5	0.01	-0.00	-0.00	-0.02	0.03	0.01	-0.03	0.13	-0.02	-0.00	-0.04	-0.04	-0.01	-0.02	-0.03	0.02	-0.01	-0.01	0.00	-0.00	-0.01	0.00	0.07	-0.06	0.02	0.00	0.05	-0.11
JPN	1,334,389	244.0	0.02	0.00	-0.01	0.07	-0.02	-0.02	0.05	0.06	-0.13	-0.03	-0.02	-0.01	-0.00	0.02	-0.11	0.13	0.07	-0.04	0.00	0.01	-0.06	-0.04	-0.07	-0.09	0.02	0.01	-0.10	-0.07
ITA	1,456,927	242.6	0.04	-0.00	0.04	-0.07	0.03	0.06	-0.06	0.14	-0.08	0.02	-0.10	-0.06	-0.07	-0.09	-0.09	0.04	-0.07	-0.03	-0.00	-0.01	0.06	-0.05	0.08	-0.09	0.05	-0.06	0.07	-0.17
AUS	998,525	236.3	0.00	-0.00	0.01	-0.01	-0.02	0.04	-0.06	-0.20	0.00	0.00	-0.02	-0.10	-0.02	-0.02	0.00	0.00	-0.02	0.01	0.00	-0.00	0.02	0.01	0.04	-0.02	0.04	-0.07	-0.01	0.02
KOR	792,561	153.7	-0.07	0.00	-0.01	0.06	-0.04	-0.04	0.11	0.02	0.03	-0.05	-0.02	0.05	-0.01	-0.03	-0.01	-0.02	0.05	-0.08	0.00	0.04	-0.03	-0.02	-0.06	0.02	-0.05	0.17	-0.01	
NLD	934,686	305.8	0.03	-0.00	-0.01	-0.01	-0.02	0.02	-0.13	-0.02	-0.02	0.03	-0.05	-0.07	-0.01	0.01	-0.06	0.04	0.01	0.01	0.00	-0.00	-0.02	0.02	0.00	0.02	0.01	0.03	-0.04	-0.04
IND	355,780	95.7	0.04	0.01	0.03	0.08	-0.02	0.07	-0.06	-0.05	-0.06	0.00	-0.10	-0.09	-0.06	0.06	0.01	0.03	0.06	0.01	-0.00	0.01	0.02	0.02	-0.14	-0.04	-0.01	0.16	-0.04	0.17
CHE	736,891	192.7	-0.07	-0.00	-0.01	-0.08	-0.01	-0.00	0.07	0.02	-0.03	0.00	0.03	0.00	-0.01	-0.08	-0.07	0.08	-0.08	0.00	0.00	-0.00	0.01	0.00	0.02	0.00	-0.00	-0.05	-0.00	0.04
POL	377,023	105.5	-0.04	0.00	-0.01	-0.01	0.01	-0.01	0.06	0.00	-0.06	-0.01	0.02	0.03	0.01	-0.02	0.09	-0.07	-0.02	0.00	0.00	0.01	0.01	0.00	-0.05	0.04	0.04	-0.08	-0.01	0.19
SWE	634,280	87.3	-0.03	0.00	-0.02	0.00	-0.01	-0.03	0.07	-0.00	0.05	0.00	0.16	0.09	0.03	0.02	-0.01	0.02	0.03	-0.00	0.00	-0.00	-0.00	0.02	-0.00	0.01	-0.02	-0.04	-0.03	-0.05
TUR	272,943	117.8	0.02	0.00	-0.05	0.13	-0.03	-0.08	-0.10	0.19	0.08	0.00	0.11	0.03	0.04	0.12	-0.11	0.09	0.16	-0.01	-0.00	0.00	0.00	-0.07	-0.03	-0.14	0.06	0.14	0.22	-0.33
BEL	563,777	438.8	0.01	-0.00	-0.01	0.05	0.01	-0.05	0.02	0.07	0.00	-0.02	0.03	0.04	0.04	0.06	0.04	-0.05	0.04	0.03	-0.00	-0.00	-0.04	-0.00	0.03	0.01	-0.02	0.11	-0.09	0.05
RUS	338,810	223.6	0.05	-0.00	0.05	-0.04	0.05	0.09	-0.16	-0.05	0.06	0.06	-0.11	-0.10	-0.08	-0.05	0.08	-0.01	-0.06	0.01	-0.00	0.00	-0.04	0.05	-0.03	0.14	-0.00	0.23	-0.06	0.02
IRN	189,304	119.9	-0.04	-0.00	0.01	-0.09	0.03	0.07	-0.12	-0.11	-0.03	0.05	-0.15	-0.10	-0.09	-0.09	-0.09	-0.01	-0.08	-0.00	0.00	-0.04	-0.04	0.06	-0.03	-0.02	0.00	-0.12	-0.01	0.01
DNK	488,052	167.0	0.00	-0.00	-0.01	-0.02	0.01	-0.03	-0.16	-0.06	0.10	0.03	0.03	0.00	0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.00	-0.01	0.01	-0.01	0.07	0.03	0.01	0.00	0.03	-0.13
TWN	322,576	80.0	-0.07	0.00	-0.02	0.00	-0.03	-0.06	0.10	0.04	-0.00	-0.04	0.07	0.10	0.00	-0.01	-0.01	0.01	0.01	-0.04	0.00	-0.00	0.03	-0.00	-0.00	-0.04	0.03	-0.03	0.00	-0.01
PRT	403,225	423.9	-0.02	0.00	0.03	-0.04	-0.00	0.05	-0.16	0.01	0.04	-0.16	-0.07	-0.08	-0.04	-0.05	-0.02	-0.01	-0.05	0.00	0.01	0.00	-0.00	0.03	0.02	-0.03	-0.21	0.32	-0.11	
ZAF	277,071	399.3	-0.10	0.00	0.02	-0.05	-0.03	0.05	-0.08	-0.06	-0.05	0.02	-0.07	-0.08	-0.04	-0.09	0.03	0.03	-0.09	0.01	0.00	-0.00	0.01	0.03	0.03	0.06	0.05	-0.51	0.13	0.21
NOR	401,917	107.8	0.05	0.00	-0.03	0.07	-0.03	-0.03	-0.07	0.01	0.08	0.01	0.04	0.02	0.01	0.08	0.05	-0.01	0.08	0.01	-0.00	0.00	-0.01	0.01	-0.02	0.02	-0.03	0.16	-0.01	0.09
AUT	403,501	156.5	0.02	0.01	-0.01	0.04	-0.09	-0.05	-0.13	0.14	0.14	0.04	0.06	0.11	0.06	0.06	0.07	-0.02	0.02	0.06	0.00	0.01	0.01	0.01	-0.09	0.09	-0.05	0.02	-0.03	0.14
CZE	331,335	228.6	0.00	-0.01	0.02	-0.02	0.09	0.04	-0.11	-0.02	0.01	0.02	-0.08	-0.08	-0.05	-0.03	0.14	-0.09	-0.01	-0.03	0.00	-0.01	-0.05	0.02	0.17	0.27	-0.08	0.02	0.07	-0.02
FIN	395,462	546.8	-0.04	-0.00	-0.03	0.04	0.01	-0.04	-0.07	0.07	-0.01	-0.03	-0.03	0.01	0.00	-0.00	0.09	-0.08	0.08	-0.05	0.00	-0.00	-0.08	0.00	0.06	0.13	-0.06	-0.12	0.02	-0.08
MEX	192,441	64.5	0.02	0.00	-0.00	0.11	-0.04	0.01	0.07	-0.01	-0.13	-0.03	-0.07	-0.01	0.03	0.11	0.12	-0.04	0.09	0.04	-0.00	0.01	-0.02	0.03	-0.08	0.01	0.02	0.11	-0.07	0.15
GRC	246,557	141.9	-0.02	0.00	-0.04	0.08	-0.04	-0.07	-0.12	0.13	0.17	0.02	0.03	0.08	0.01	0.07	-0.03	0.02	0.10	-0.02	0.00	-0.00	-0.02	-0.00	-0.00	-0.01	-0.05	-0.08	-0.05	-0.05
ARG	135,099	44.0	0.01	-0.00	-0.00	0.02	0.03	-0.03	0.15	-0.21	-0.16	-0.04	0.06	0.04	0.05	0.03	0.01	-0.02	0.02	0.03	-0.00	-0.00	-0.03	0.01	0.02	-0.01	0.02	0.13	-0.09	-0.01
ISR	204,154	75.3	-0.00	0.01	-0.01	-0.01	-0.05	0.03	0.07	0.11	0.03	0.01	-0.08	-0.04	-0.03	-0.05	0.02	-0.00	-0.02	-0.03	0.00	-0.01	-0.02	0.01	-0.13	-0.04	-0.03	-0.04	0.02	-0.12
THA	186,695	4106.1	0.03	-0.01	-0.00	0.04	0.06	-0.02	0.06	-0.03	-0.04	-0.01	0.13	0.07	0.06	0.09	0.05	-0.02	0.01	0.04	-0.00	-0.00	-0.06	0.01	0.04	0.03	-0.02	0.16	-0.07	0.05
NZL	147,677	89.1	0.01	-0.00	0.05	-0.03	0.01	0.07	-0.07	-0.10	-0.01	0.03	-0.10	-0.11	-0.04	-0.02	-0.00	-0.01	-0.03	0.02	0.00	-0.00	0.03	-0.01	-0.01	0.00	-0.00	-0.09	-0.03	0.02
MYS	123,291	96.4	0.01	-0.00	0.01	0.01	-0.00	-0.02	0.03	0.06	-0.00	-0.03	-0.01	-0.01	-0.01	-0.02	0.00	0.00	0.01	-0.06	-0.00	-0.00	0.00	0.02	0.07	-0.08	0.07	0.04	0.05	-0.01
IRL	192,161	225.8	-0.08	-0.00	0.01	-0.12	0.01	0.01	0.08	-0.01	-0.06	-0.03	-0.02	-0.01	-0.04	-0.12	-0.09	0.04	-0.07	-0.06	0.00	-0.01	0.06	-0.03	0.09	-0.12	0.03	-0.07	-0.07	-0.15
CHL	127,798	50.0	-0.03	0.01	0.03	-0.24	-0.07	0.06	-0.00	0.12	0.05	-0.12	-0.07	-0.07	-0.26	-0.04	-0.03	-0.22	0.01	0.00	0.00	0.02	0.01	-0.03	-0.00	-0.02	-0.10	-0.04	-0.13	
HUN	156,584	110.6	-0.00	0.00	-0.00	0.04	-0.02	0.00	0.05	-0.16	-0.11	-0.01	0.05	-0.01	0.04	0.04	-0.03	0.08	0.03	0.02	0.00	-0.00	-0.07	0.03	-0.05	-0.03	0.05	0.10	-0.12	0.17
PAK	94,225	202.4	-0.08	-0.00	0.00	-0.04	-0.01	0.01	-0.04	0.13	0.06	0.00	-0.02	-0.02	-0.02	-0.02	-0.09	0.05	-0.04	0.02	0.00	-0.00	0.03	0.03	-0.00	-0.12	0.05	-0.02	-0.03	-0.23
EGY	96,241	150.5	0.10	0.00	0.00	-0.04	0.03	-0.01	0.12	-0.09	-0.00	-0.00	0.05	0.11	0.06	0.04	-0.00	-0.05	-0.03	0.04	-0.00	0.00	0.05	-0.02	-0.02	0.04	-0.05	0.05	-0.01	0.09
SAU	145,007	294.8	0.07	-0.01	0.01	-0.03	0.06	-0.01	0.13	-0.15	0.01	0.00	0.12	0.17	0.06	-0.01	-0.01	-0.03	-0.06	0.04	-0.00	-0.00	0.08	-0.01	0.02	0.08	-0.03	0.08	0.07	-0.00
SGP	118,386	81.1	-0.09	-0.01	0.04	-0.21	0.10	0.02	0.30	-0.11	0.17	-0.00	0.17	0.07	0.05	-0.18	-0.04	0.04	-0.20	0.03	0.00	-0.00	0.02	0.01	0.03	0.02	-0.04	-0.19	-0.06	-0.00
ROU	80,139	45.3	0.10	0.00	-0.05	0.07	-0.00	-0.09	0.06	-0.00	-0.17	-0.03	0.13	0.12	0.06	0.09	0.01	-0.01	0.06	-0.00	-0.00	0.00	0.02	-0.01	-0.02	0.02	-0.05	0.20	-0.05	0.08
SRB	85,290	184.4	0.02	-0.00	0.04	-0.00	0.07	0.04	0.08	-0.07	0.08	-0.03	-0.07	-0.10	-0.02	-0.01	0.02	-0.03	-0.00	-0.05	0.00	-0.01	0.00	0.01	0.22	-0.11	0.04	0.03	0.17	-0.31
SVK	74,869	62.4	-0.03	0.01	-0.02	-0.00	-0.03	0.05	0.06	0.16	0.02	0.03	-0.06	-0.00	0.01	0.03	0.03	-0.00	-0.02	0.01	0.00	0.02	0.01	-0.08	-0.02	0.01	0.05	0.01	-0.07	
HRV	61,990	63.9	-0.01	0.01	0.00	-0.00	-0.01	0.00	-0.06	0.11	0.18	0.01	-0.01	-0.04	-0.02	-0.00	-0.09	0.05	-0.00	-0.00	0.00	0.01	0.03	-0.06	0.01	-0.06	0.01	-0.28	-0.19	0.01
SVN	55,977	114.4	0.10	-0.00	0.03	0.02	0.04	-0.00	-0.04	0.21	0.12	-0.00	-0.02	-0.02	-0.02	0.01	-0.07	0.03	0.03	-0.08	0.00	0.02	0.00	-0.07	-0.19	0.02	-0.03	-0.09	-0.01	0.24
BGR	52,172	45.5	0.08	0.01	-0.03	0.11	-0.04	-0.00	-0.00	0.03	-0.04	-0.01	0.03	-0.03	0.03	0.14	0.09	-0.02	0.10	0.04	-0.00	0.00	0.01	-0.02	-0.05	0.05	-0.04	0.40	-0.02	0.07
EST	75,920	143.7	-0.08	-0.00	-0.01	-0.14	0.06	0.02	-0.12	0.02	0.07	0.05	-0.15	-0.08	-0.04	-0.10	-0.02	-0.05	-0.12	0.03	0.00	-0.01	0.03	-0.02	0.08	0.02	-0.03	-0.16	0.02	-0.05

Table S12: Relative importance differences of the categories for countries in Mathematics & Computer science for deltas 3→10

country	edges	mpe	CC	MC	MEC	MPEC	TC	ETC	EP	EPC	EPE	OEP	OEPC	OEPE	I	IM	IMI	IMO	M_{all}	IM_m	M	CM	MP	MS	PM	MTC	MSC	M2	RFM	VM
WORLD	4,643,439	145.9	-0.00	0.01	-0.00	0.00	-0.01	-0.00	-0.00	0.00	-0.00	-0.01	-0.00	-0.00	-0.01	-0.00	0.00	0.01	0.00	-0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	-0.00
CHN	1,283,720	120.2	0.00	-0.00	0.01	-0.02	-0.03	-0.00	0.05	-0.11	0.07	-0.01	-0.02	-0.01	0.00	-0.01	0.00	-0.01	0.02	-0.01	-0.01	0.00	0.00	0.04	-0.03	-0.03	-0.01	-0.01	-0.04	-0.05
USA	1,131,649	147.7	-0.02	0.00	0.02	-0.05	0.02	0.04	-0.05	0.23	-0.10	0.01	-0.11	-0.06	-0.03	-0.03	-0.08	0.06	-0.03	-0.00	0.00	-0.01	-0.01	-0.02	0.18	-0.15	-0.00	-0.10	-0.03	-0.11
GBR	391,986	92.1	0.01	-0.00	-0.03	-0.01	-0.03	0.02	-0.07	0.00	0.06	0.01	-0.04	-0.05	-0.05	0.02	-0.08	0.06	-0.00	0.02	0.00	-0.00	-0.02	0.03	-0.02	-0.01	-0.03	-0.02	-0.02	0.06
FRA	359,777	69.8	-0.01	0.00	0.01	-0.06	0.00	0.04	-0.12	0.05	0.11	0.03	-0.07	-0.04	-0.04	-0.13	-0.00	-0.02	-0.02	-0.10	0.00	-0.00	-0.02	-0.01	0.04	0.03	-0.04	-0.03	-0.06	-0.08
DEU	334,192	47.4	-0.03	0.00	0.01	-0.04	-0.03	0.03	-0.02	-0.01	0.04	0.03	-0.04	-0.03	-0.03	-0.05	-0.06	0.07	-0.03	-0.03	0.00	0.01	0.03	-0.01	-0.07	-0.11	0.07	-0.10	0.07	-0.02
ITA	292,600	161.0	0.05	-0.00	0.02	-0.07	0.05	0.04	-0.01	0.16	-0.02	0.02	-0.06	-0.05	-0.04	-0.05	-0.05	0.03	-0.05	-0.00	-0.00	-0.03	0.01	0.11	0.07	-0.04	0.10	0.23	-0.17
CAN	214,910	90.8	-0.04	0.00	-0.01	-0.03	-0.04	-0.05	0.01	0.07	0.07	-0.04	0.02	-0.00	-0.00	0.01	-0.08	0.08	0.01	0.01	0.00	-0.00	-0.01	0.01	0.01	-0.06	-0.03	-0.05	-0.08	-0.02
ESP	293,019	140.1	0.03	0.00	-0.01	0.01	0.01	-0.02	0.03	0.15	-0.02	-0.01	-0.01	-0.02	-0.00	-0.01	-0.13	0.11	0.04	-0.07	-0.00	0.00	-0.04	-0.02	0.04	-0.13	0.02	0.05	-0.02	-0.17
KOR	250,835	51.7	-0.05	0.01	-0.00	-0.01	-0.08	-0.04	-0.08	-0.03	0.18	0.01	0.03	0.13	-0.03	-0.05	-0.04	0.02	-0.00	-0.07	0.00	0.00	-0.01	0.02	-0.04	-0.06	0.04	-0.13	0.08	-0.11
JPN	227,246	121.6	-0.01	0.00	-0.01	0.04	0.04	-0.03	0.00	0.05	-0.15	0.01	0.00	0.00	-0.00	-0.01	-0.05	0.02	0.03	-0.08	0.00	-0.00	-0.01	-0.01	0.08	-0.09	0.07	-0.23	0.25	-0.00
TWN	161,713	127.3	0.03	0.00	0.05	-0.06	-0.05	0.07	0.58	-0.32	0.09	-0.13	0.07	0.06	0.12	-0.03	0.02	-0.02	-0.04	0.00	0.00	0.01	0.08	-0.08	-0.22	-0.02	-0.06	-0.07	-0.01	-0.08
AUS	148,597	186.0	-0.01	-0.00	-0.02	0.06	-0.01	-0.02	-0.10	-0.00	0.16	-0.01	-0.04	-0.06	0.01	0.09	0.16	-0.11	0.07	0.02	0.00	-0.00	-0.02	-0.00	0.00	0.09	-0.05	0.01	0.01	-0.05
IRN	80,026	71.4	-0.02	-0.00	-0.02	0.07	-0.01	-0.00	-0.03	0.04	0.30	-0.00	-0.08	-0.00	-0.06	-0.04	-0.03	-0.02	0.07	-0.11	0.00	0.00	-0.06	0.00	-0.07	-0.12	0.07	-0.20	0.05	-0.05
IND	77,153	56.3	0.06	0.00	0.03	0.07	-0.01	0.07	0.39	-0.11	0.19	-0.12	-0.06	-0.05	0.01	0.06	0.06	-0.08	0.05	0.02	-0.00	0.00	-0.03	-0.03	-0.02	-0.14	0.09	0.12	0.13	-0.15
BRA	94,752	44.9	0.04	-0.00	-0.00	0.03	0.02	-0.02	0.03	0.09	-0.12	-0.00	0.07	0.02	-0.02	-0.03	-0.04	0.08	0.03	-0.09	-0.00	0.01	-0.07	0.06	-0.06	0.01	-0.01	0.06	0.23	-0.06
NLD	122,442	47.3	0.04	0.01	0.02	0.02	-0.12	0.04	-0.06	0.03	0.10	0.03	-0.04	0.03	0.05	0.03	0.05	0.03	-0.04	0.01	-0.00	0.01	0.12	-0.05	-0.13	0.08	0.02	0.15	0.07	-0.05
TUR	53,235	47.3	0.03	-0.01	-0.05	-0.00	0.06	-0.04	-0.10	0.04	0.08	0.00	-0.01	0.01	-0.05	0.01	-0.04	-0.04	-0.03	-0.02	0.00	-0.01	-0.01	0.02	0.07	-0.14	-0.01	-0.09	-0.06	-0.28
SGP	97,915	123.5	-0.01	0.00	-0.03	0.29	-0.05	-0.04	-0.04	-0.12	0.01	-0.05	-0.02	-0.04	0.04	0.29	-0.22	0.29	0.23	0.07	0.00	0.00	-0.07	-0.08	-0.04	-0.21	0.16	-0.14	0.12	0.03
POL	70,217	51.4	0.06	0.00	0.01	-0.18	-0.01	-0.03	-0.04	0.03	0.16	0.04	0.06	0.06	0.01	-0.17	0.02	-0.01	-0.18	0.03	-0.00	-0.00	0.09	0.01	-0.01	0.10	-0.02	0.04	-0.10	0.01
RUS	77,732	42.8	-0.03	-0.00	0.04	-0.12	0.08	0.08	-0.03	0.06	-0.03	0.05	-0.05	-0.06	-0.08	-0.16	0.03	0.04	-0.16	0.01	-0.00	-0.00	0.03	0.02	0.06	0.03	0.05	0.34	0.26	0.04
BEL	116,239	300.2	0.03	-0.00	-0.00	-0.05	-0.00	-0.02	-0.04	0.02	0.11	0.03	0.04	-0.02	-0.03	0.04	-0.02	-0.04	0.01	0.00	0.00	0.00	0.00	0.02	-0.00	-0.06	0.03	0.04	0.25	-0.15
CHE	107,402	57.9	-0.00	0.01	0.01	0.04	-0.07	0.04	-0.09	-0.18	0.01	0.01	-0.08	-0.02	-0.01	0.03	-0.01	0.01	0.01	0.02	0.00	0.00	0.07	0.01	0.00	0.06	-0.04	-0.03	-0.16	0.04
SWE	78,753	55.9	0.01	0.00	0.01	-0.03	-0.02	0.02	-0.04	0.05	0.08	0.02	-0.04	-0.03	-0.01	0.00	0.02	-0.01	-0.04	0.04	-0.00	-0.00	0.02	0.03	0.00	0.04	-0.02	0.13	-0.06	0.04
GRC	60,800	81.5	-0.32	0.01	0.02	-0.09	0.02	0.06	-0.09	0.08	0.03	0.01	-0.14	-0.09	-0.09	-0.05	-0.17	0.08	-0.02	-0.03	-0.00	-0.01	0.05	-0.01	0.12	-0.05	-0.00	-0.15	0.18	-0.31
ISR	43,915	48.6	-0.04	-0.00	-0.00	0.01	-0.02	-0.05	0.13	0.23	-0.09	-0.08	0.10	-0.13	0.01	0.06	-0.03	0.02	0.08	-0.01	-0.00	-0.00	-0.04	0.02	0.03	-0.07	-0.08	0.04	0.02	-0.17
PRT	59,001	82.3	0.47	-0.01	-0.07	-0.08	-0.03	-0.01	-0.13	0.13	-0.01	0.02	0.06	-0.03	-0.07	-0.15	0.08	-0.07	0.00	-0.00	-0.00	0.00	-0.01	-0.03	0.09	-0.18	0.09	0.12	0.19	-0.20
AUT	53,925	36.1	-0.01	0.01	-0.02	0.02	-0.10	-0.03	0.03	0.05	0.03	0.00	0.02	0.07	0.02	0.04	0.01	-0.01	0.03	0.01	-0.00	0.02	-0.04	-0.03	-0.23	0.02	-0.06	0.18	-0.02	-0.02
FIN	60,008	58.3	0.03	-0.00	0.00	-0.11	0.02	0.02	-0.10	-0.00	-0.00	-0.00	-0.05	-0.02	-0.05	-0.12	-0.03	0.02	-0.10	-0.00	-0.00	-0.01	-0.04	-0.04	0.10	-0.04	0.05	0.12	0.07	0.04
SAU	45,928	309.5	-0.00	-0.01	0.02	-0.12	0.05	0.02	0.05	-0.10	0.04	-0.01	0.01	0.04	-0.00	-0.08	-0.03	-0.08	-0.12	0.03	0.00	0.00	0.08	-0.02	0.04	-0.00	0.01	-0.11	-0.08	-0.05
CZE	39,860	89.9	-0.01	0.01	0.01	0.06	-0.05	-0.05	0.00	0.05	-0.03	0.01	0.07	0.03	0.06	0.06	0.16	0.01	0.02	0.04	-0.00	0.01	-0.01	0.02	-0.10	0.06	-0.00	0.15	0.25	-0.18
ROU	30,765	68.9	0.02	-0.02	-0.05	0.04	0.13	0.00	-0.12	0.00	-0.17	0.02	-0.02	-0.01	-0.03	0.06	0.01	-0.05	0.04	0.02	0.00	-0.01	-0.09	0.11	0.09	0.28	0.00	-0.08	-0.06	-0.24
DNK	46,654	86.8	0.01	-0.00	0.02	0.14	0.01	-0.04	-0.01	-0.07	-0.05	-0.00	-0.03	0.10	0.04	0.17	0.02	-0.09	0.12	0.04	0.00	-0.00	0.04	-0.10	0.00	0.15	-0.01	-0.05	-0.29	0.18
NOR	35,979	38.6	0.08	-0.02	-0.06	0.19	0.14	-0.06	-0.16	-0.00	0.02	0.04	0.08	-0.02	0.04	0.22	0.04	0.19	0.03	-0.04	-0.00	0.00	0.03	-0.05	0.05	-0.03	0.00	0.21	-0.04	0.17
MYS	33,254	196.0	0.05	-0.00	0.03	-0.03	-0.03	0.03	-0.02	0.07	0.13	0.03	-0.04	-0.04	-0.02	-0.02	-0.11	0.11	-0.03	0.03	0.00	-0.00	-0.04	0.08	-0.07	0.00	-0.02	-0.18	0.08	
MEX	26,210	42.4	-0.05	-0.00	-0.01	-0.05	0.06	-0.11	0.05	-0.01	0.06	0.02	0.17	0.12	0.07	-0.08	0.05	-0.01	-0.09	-0.01	0.00	0.00	-0.05	0.10	0.00	0.02	0.02	-0.39	0.21	0.08
IRL	34,129	232.6	0.31	0.00	0.08	-0.03	-0.20	-0.01	0.34	-0.05	-0.05	-0.12	0.01	0.13	-0.00	0.36	-0.21	-0.02	0.04	-0.00	0.01	0.03	-0.14	-0.19	-0.18	0.02	0.21	-0.31	0.24	
ZAF	15,775	62.4	-0.02	0.00	0.02	0.05	-0.04	-0.05	-0.09	-0.05	0.01	0.02	-0.03	0.20	0.02	0.07	0.13	-0.11	0.02	0.03	0.00	-0.00	0.04	-0.02	-0.04	0.25	-0.07	-0.08	-0.25	0.36
HUN	19,815	29.4	-0.09	0.00	-0.00	-0.11	0.01	0.02	-0.14	0.06	-0.15	0.05	-0.09	-0.01	-0.14	0.04	-0.06	-0.12	-0.01	-0.01	0.00	-0.00	-0.05	0.06	0.07	-0.03	-0.06			
CHL	19,672	46.1	0.01	0.00	0.03	0.18	-0.02	0.05	0.26	-0.26	-0.29	-0.05	0.15	-0.04	0.06	0.11	0.22	-0.12	0.13	-0.01	-0.00	0.02	-0.07	-0.04	-0.37	0.04	0.13	0.45	-0.03	0.01
NZL	19,400	33.5	-0.03	0.01	0.02	0.14	-0.08	-0.04	0.08	0.00	-0.03	-0.04	0.14	-0.04	0.08	0.17	-0.02	0.02	0.15	0.03	-0.00	0.00	-0.10	0.09	-0.09	-0.01	0.00	0.18	-0.35	0.06
SRB	16,698	51.5	-0.01	-0.00	0.02	0.03	0.07	0.01	-0.10	0.18	-0.03	0.02	-0.13	-0.11	-0.00	0.05	-0.07	0.06	0.04	0.02	-0.00	0.00	0.00	0.00	0.10	0.23	-0.12	-0.22	0.09	0.10
SVN	16,564	48.8	-0.03	-0.00	-0.01	-0.01	0.07	-0.05	-0.03	0.24	-0.09	-0.00	0.00	-0.02	0.01	-0.02	-0.05	0.00	-0.01	-0.02	0.00	-0.02	-0.00	0.00	0.41	-0.06	0.03	-0.02	0.05	0.12
DZA	14,719	37.6	-0.00	-0.00	-0.01	0.09	0.09	-0.04	-0.29	-0.14	-0.25	0.07	0.17	-0.12	-0.01	0.09	0.04	0.03	0.05	0.04	0.00	-0.00	-0.19	0.10	0.13	0.06	0.06	-0.08	-0.05	0.14
EGY	13,937	63.5	0.04	-0.00	-0.01	-0.09	0.10	-0.01	-0.03	0.08	-0.00	-0.00	0.05	0.09	-0.01	0.01	-0.07	-0.05	-0.04	0.04	0.00	-0.00	0.02	0.00	0.04	0.05	-0.09	-0.08	-0.02	-0.29
THA	12,739	31.4	-0.18	0.00	0.00	0.05	0.09	-0.01	-0.03	0.16	0.13	0.02	0.05	-0.10	-0.04	0.01	-0.00	0.15	0.08	-0.04	-0.00	-0.01	-0.04	0.13	0.03	0.03	-0.09	0.25	-1.00	1.19
PAK	16,841	762.6	-0.22	0.00	-0.02	-0.19	-0.04	-0.03	-0.04	0.01	0.04	0.00	-0.09	0.13	-0.02	-0.09	-0.06	-0.04	-0.11	0.01	0.00	-0.00	0.24	-0.11	-0.02	0.08	0.00	-0.32	0.06	-0.14
UKR	16,910	26.7	-0.11	-0.00	0.01	-0.10	0.15	-0.02	0.05	-0.01	0.05	0.02	0.19	0.01	0.04	-0.17	-0.01	0.03	-0.17	0.02	0.00	-0.00	0.00	0.15	0.01	-0.05	0.06	-0.28	0.32	0.43
SVK	14,609	168.5	0.03	-0.00	-0.01	-0.02	-0.07	0.01	-0.11	-0.06	-0.22	0.04	-0.02	0.10	0.01	-0.03	0.05	0.02	-0.02	-0.00	0.00	-0.00	0.00	-0.01	-0.01	-0.09	0.25	-0.11	-0.04	0.03
ARG	9,940	32.2	0.08	0.00	-0.02	0.22	-0.06	-0.04	0.16	-0.36	-0.07	-0.05	0.10	0.03	0.08	0.18	0.06	-0.02	0.11	0.05	-0.00	0.00	-0.04	-0.01	-0.05	-0.03	0.04	0.56	-0.01	0.05
HRV	8,372	55.6	-0.18	0.00	0.01	-0.10	0.01	0.16	0.12	-0.46	-0.30	-0.01	-0.14	-0.00	-0.05	-0.09	0.09	-0.19	-0.07	-0.07	0.00	-0.00	0.12	-0.10	-0.00	0.12	-0.10	-0.47	0.19	-0.23