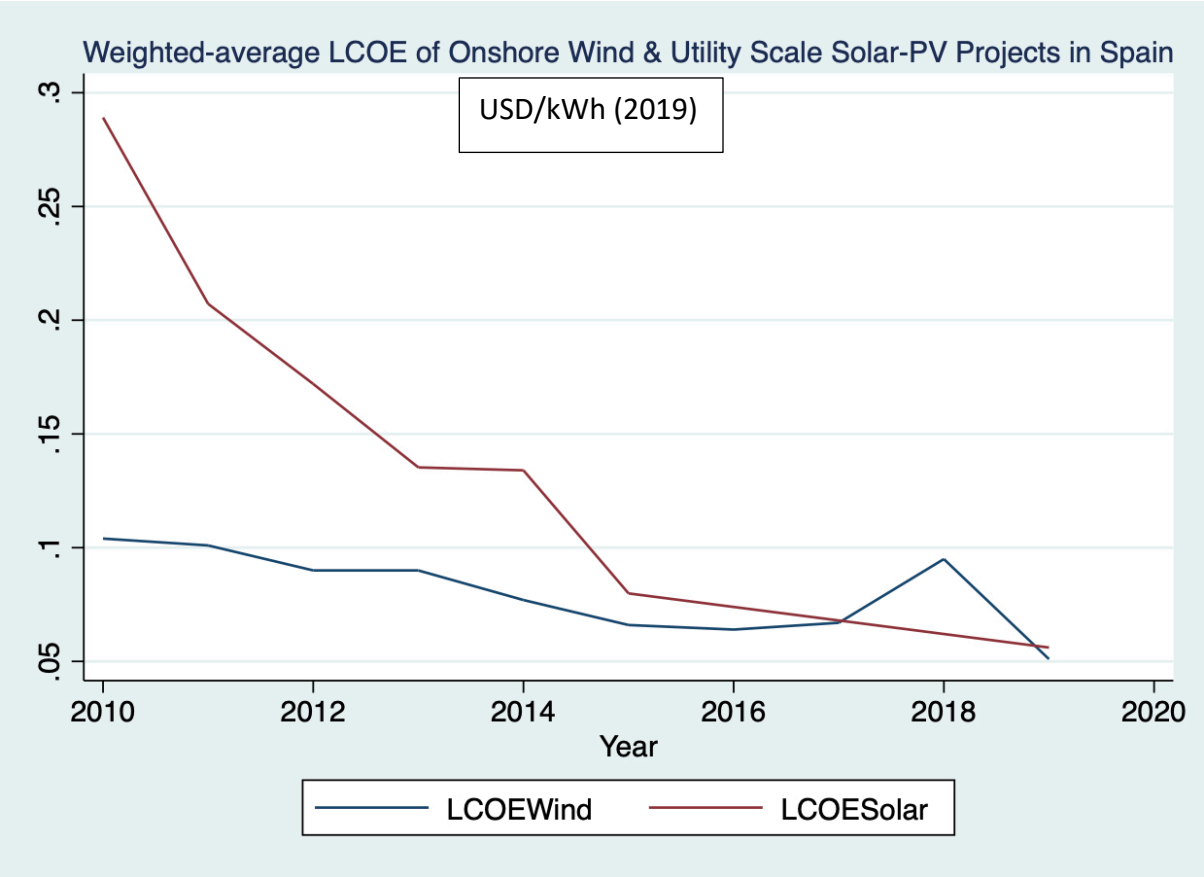
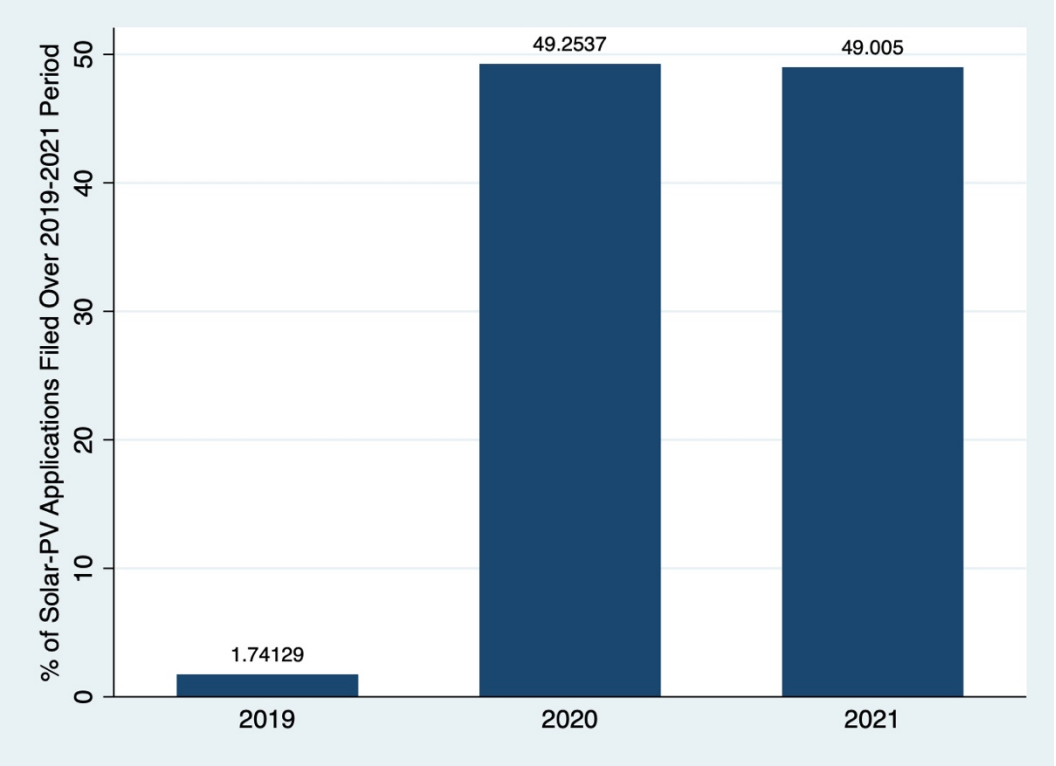
Annexes: “Renovables sí, però així no?”

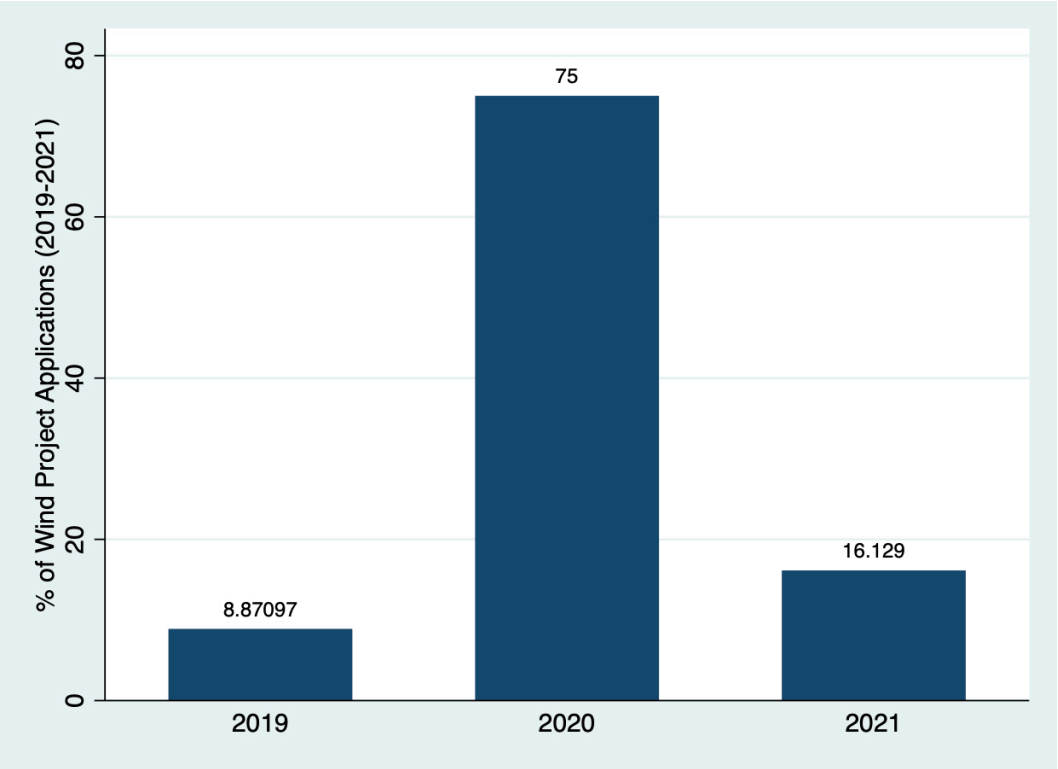
Annex 0

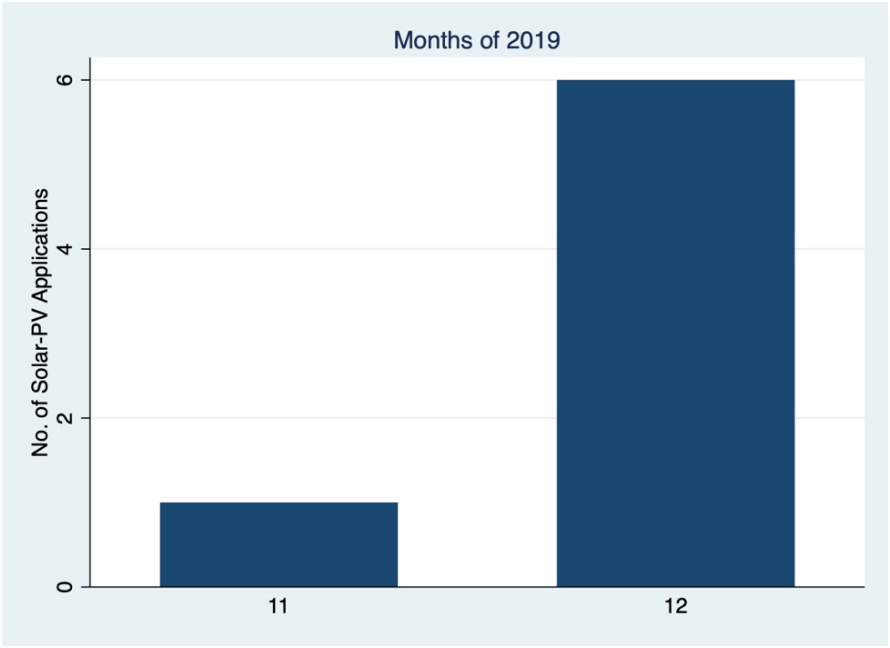


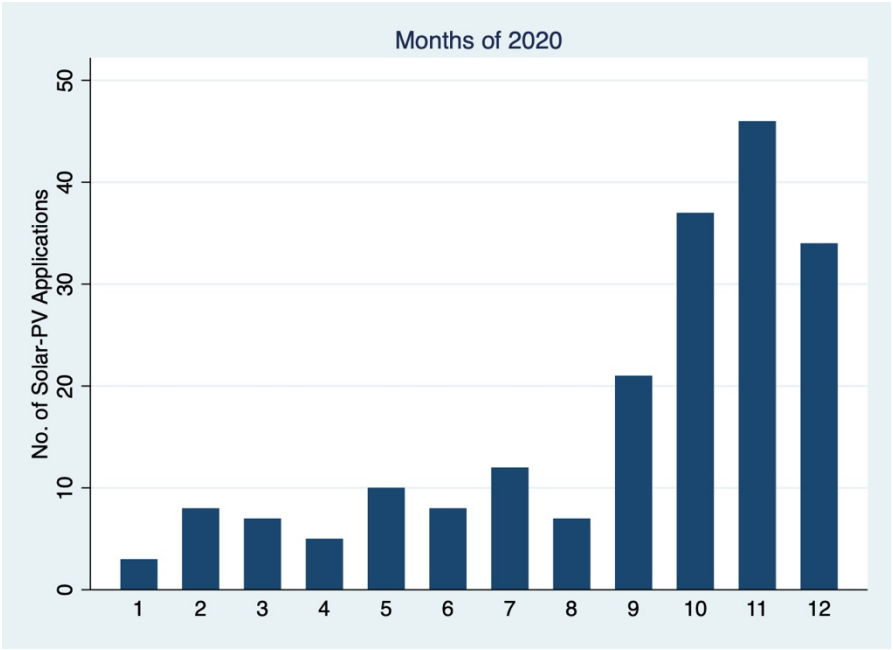
Source: IRENA., 2020. Renewable Power Generation Costs in 2019, International Renewable Energy Agency, Abu Dhabi.

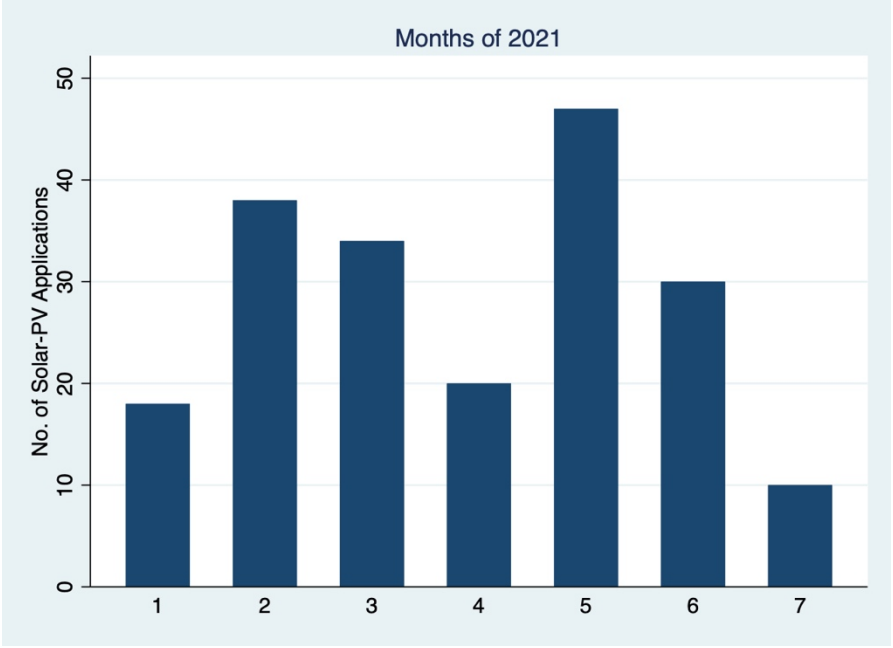
Annex 1A

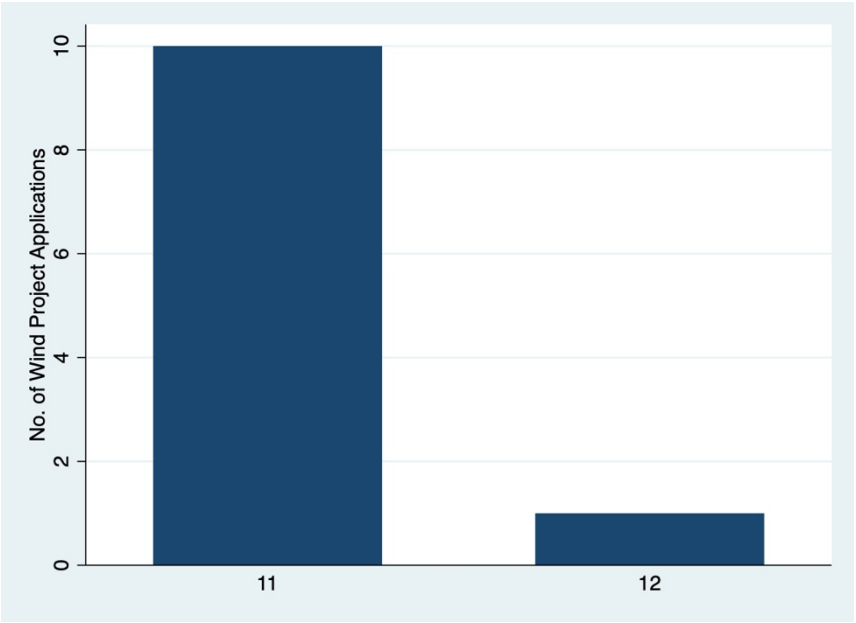

% of Solar-PV Applications Filed Over 2019-2021 Period
0
10
20
30
40
50
1.74129
49.2537
49.005
2019
2020
2021

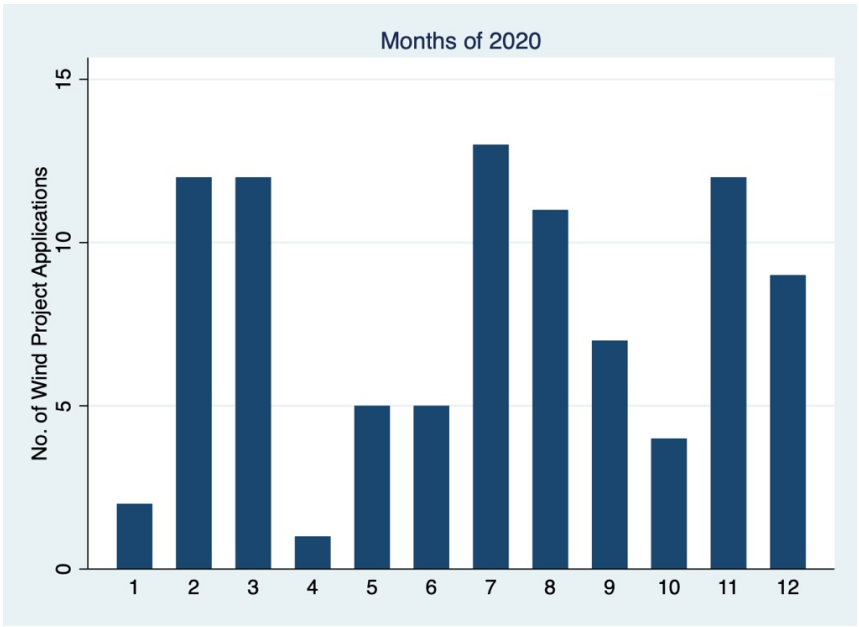

% of Wind Project Applications (2019-2021)
0
20
40
60
80
8.87097
75
16.129
2019
2020
2021

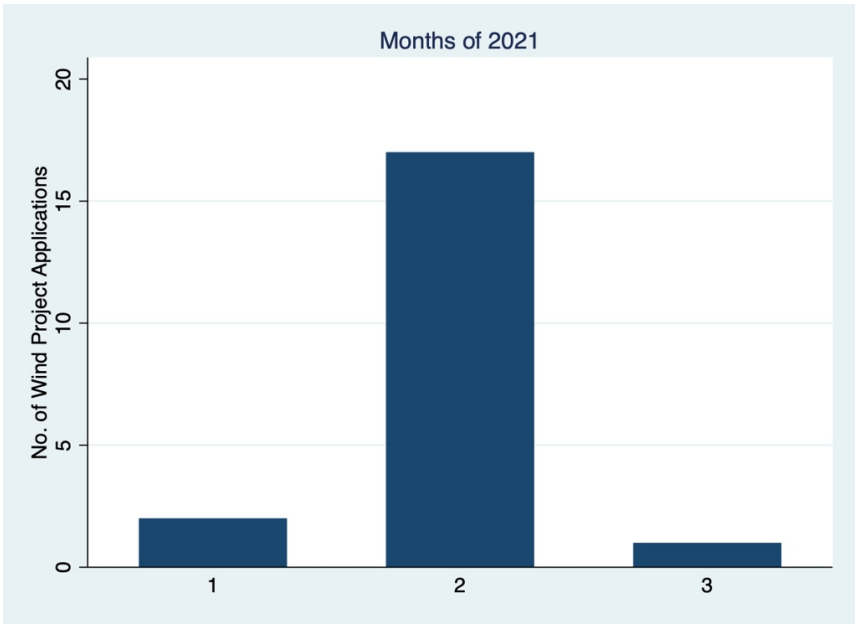

Months of 2019
No. of Solar-PV Applications
0
2
4
6
11
12


Months of 2020
No. of Solar-PV Applications
0
10
20
30
40
50
1
2
3
4
5
6
7
8
9
10
11
12

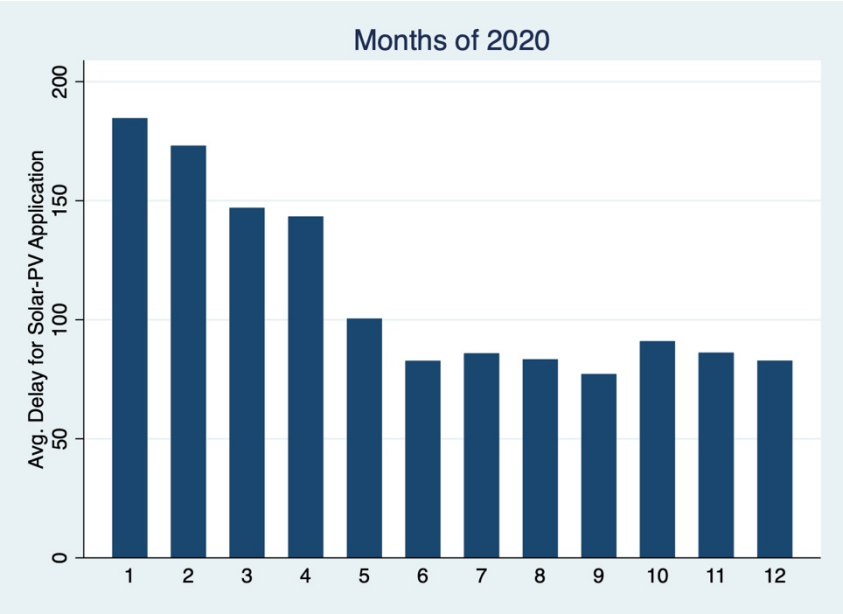

Months of 2021
No. of Solar-PV Applications
0
10
20
30
40
50
1
2
3
4
5
6
7


No. of Wind Project Applications
0
2
4
6
8
10
11
12

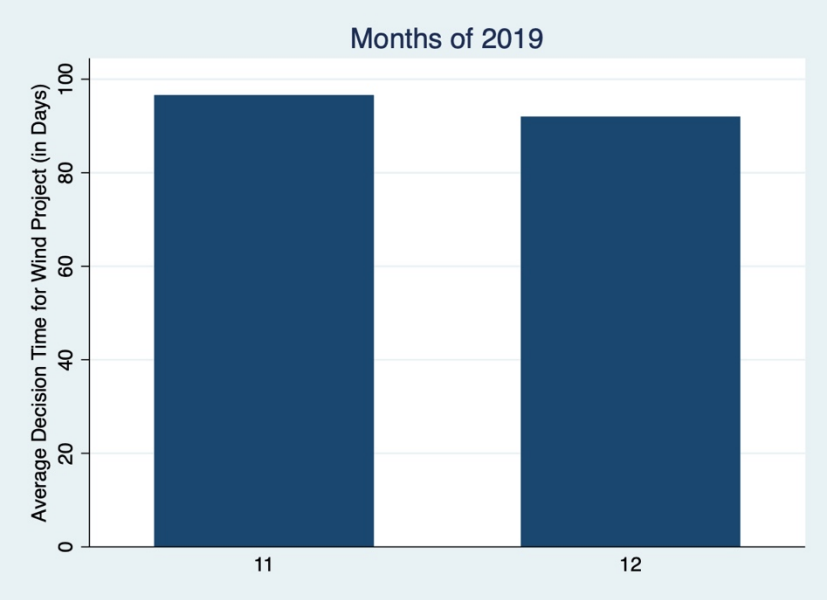

Months of 2020
No. of Wind Project Applications
0
5
10
15
1
2
3
4
5
6
7
8
9
10
11
12


Months of 2021
No. of Wind Project Applications
0
5
10
15
20
1
2
3

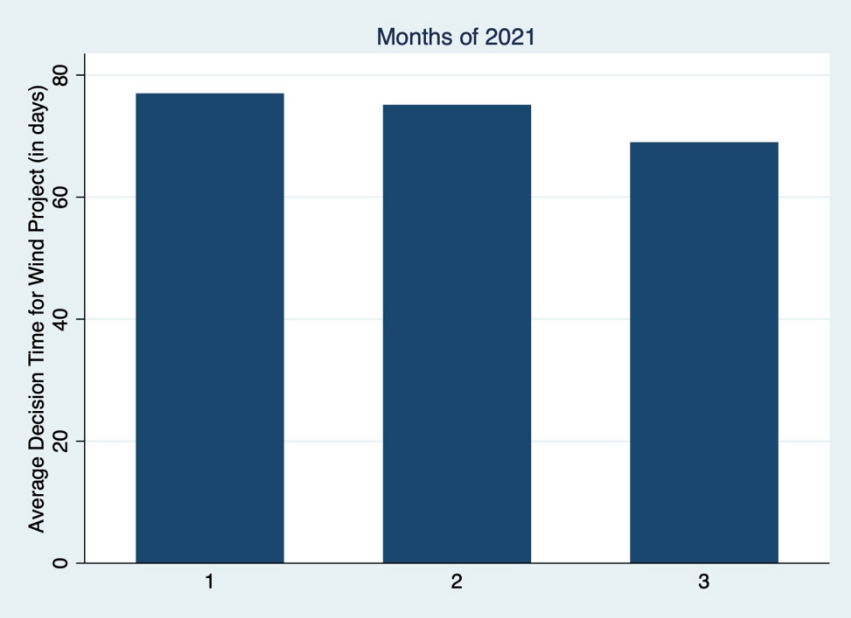
Annex 1B


Months of 2020
Avg. Delay for Solar-PV Application
0
50
100
150
200
1
2
3
4
5
6
7
8
9
10
11
12


Months of 2021
Avg. Delay for Solar-PV
0
20
40
60
80
100
1
2
3
4
5
6
7


Months of 2019
Average Decision Time for Wind Project (in Days)
0
20
40
60
80
100
11
12


Months of 2020
Average Decision Time for Wind Project (in days)
0
50
100
150
200
1
2
3
4
5
6
7
8
9
10
11
12


Months of 2021
Average Decision Time for Wind Project (in days)
0
20
40
60
80
1
2
3

Annex 2A

Our samples of solar-PV and wind project applications from DATASET C are compatible with the following assumptions.

1. Our samples are representative because it contains observations on solar-PV and wind projects applications from all regions of Catalonia. To the best of our knowledge, no. criteria or bias affecting their inclusion or exclusion in DATASET C. Our analysis also avoids any bias. Our analysis naturally filters out observations with missing values on the decision time variable*(deldec)* but there was no systemic selection bias weakening the randomness and representativeness of the sample.
2. Our samples are also sufficiently large (N>50) with 266 and 124 non-missing observations on *lag* for solar-PV and wind project applications respectively. "Because our sample size is sufficiently large ($N > 50$), we know, based on the central limit theorem, that the sampling distribution of the mean will be approximately normal" **Leon-Guerrero and Frankfort-Nachmias, 2017, p.159)**. Therefore, the normality assumption is also met.
3. Bartlett's test shows that our samples on wind and solar-PV project applications are very likely to have unequal variances on the *deldec* variable when grouped and compared based on the year of filing (variable *datenew*). Therefore, to adjust for these unequal variances in calculating confidence intervals and conducting pairwise comparison of difference of means, we use methods developed by Games and Howell (cited in Tamhane, 1979) and other authors (see next page).

Bartlett's equal-variances test for the sample of wind project applications. The P value (prob>chi2) indicates that we can reject the null hypothesis of equal variances at the 0.01 significance level.

```
. oneway deldec datenew

                    Analysis of variance
    Source              SS         df      MS            F     Prob > F
------------------------------------------------------------------------
Between groups      15483.3556       2   7741.67779      8.31     0.0004
 Within groups      112690.862     121   931.329439
------------------------------------------------------------------------
    Total           128174.218     123   1042.06681

Bartlett's equal-variances test: chi2(2) =  77.2656    Prob>chi2 = 0.000
```

Bartlett's equal-variances test for the sample of solar-PV applications. The P value (prob>chi2) indicates that we can reject the null hypothesis of equal variances at the 0.01 significance level.

```
. oneway deldec datenew

                        Analysis of variance
    Source              SS         df      MS            F     Prob > F
------------------------------------------------------------------------
Between groups      29816.1188      2   14908.0594     15.18     0.0000
 Within groups      258286.287    263   982.077138
------------------------------------------------------------------------
    Total           288102.406    265   1087.17889

Bartlett's equal-variances test: chi2(2) =  95.2165    Prob>chi2 = 0.000
```

Annex 2B

```
(FOR SOLAR-PV)
Pairwise comparisons of means (unequal variances)

------------------------------------------------------------------------------
             |                                      Dunnett's C
         lag |    Diff.     Std.Err       [95% Conf. Interval]
-------------+----------------------------------------------------------------
     datenew |
 2020 vs 2019|  -48.80231   14.35708     -92.54487   -5.059751
 2021 vs 2019|  -64.21546   14.18622     -107.6771   -20.75381
 2021 vs 2020|  -15.41315   2.770149     -21.97606   -8.850235
------------------------------------------------------------------------------


------------------------------------------------------------------------------
             |                                    Games and Howell
         lag |    Diff.     Std.Err       [95% Conf. Interval]
-------------+----------------------------------------------------------------
     datenew |
 2020 vs 2019|  -48.80231   14.35708     -92.09845   -5.506163
 2021 vs 2019|  -64.21546   14.18622     -107.5686   -20.86234
 2021 vs 2020|  -15.41315   2.770149     -21.94398   -8.882313
------------------------------------------------------------------------------


------------------------------------------------------------------------------
             |                                     Tamhane's T2
         lag |    Diff.     Std.Err       [95% Conf. Interval]
-------------+----------------------------------------------------------------
     datenew |
 2020 vs 2019|  -48.80231   14.35708     -94.82865   -2.775971
 2021 vs 2019|  -64.21546   14.18622     -110.4332   -17.99771
 2021 vs 2020|  -15.41315   2.770149     -22.07156   -8.754732
------------------------------------------------------------------------------
```

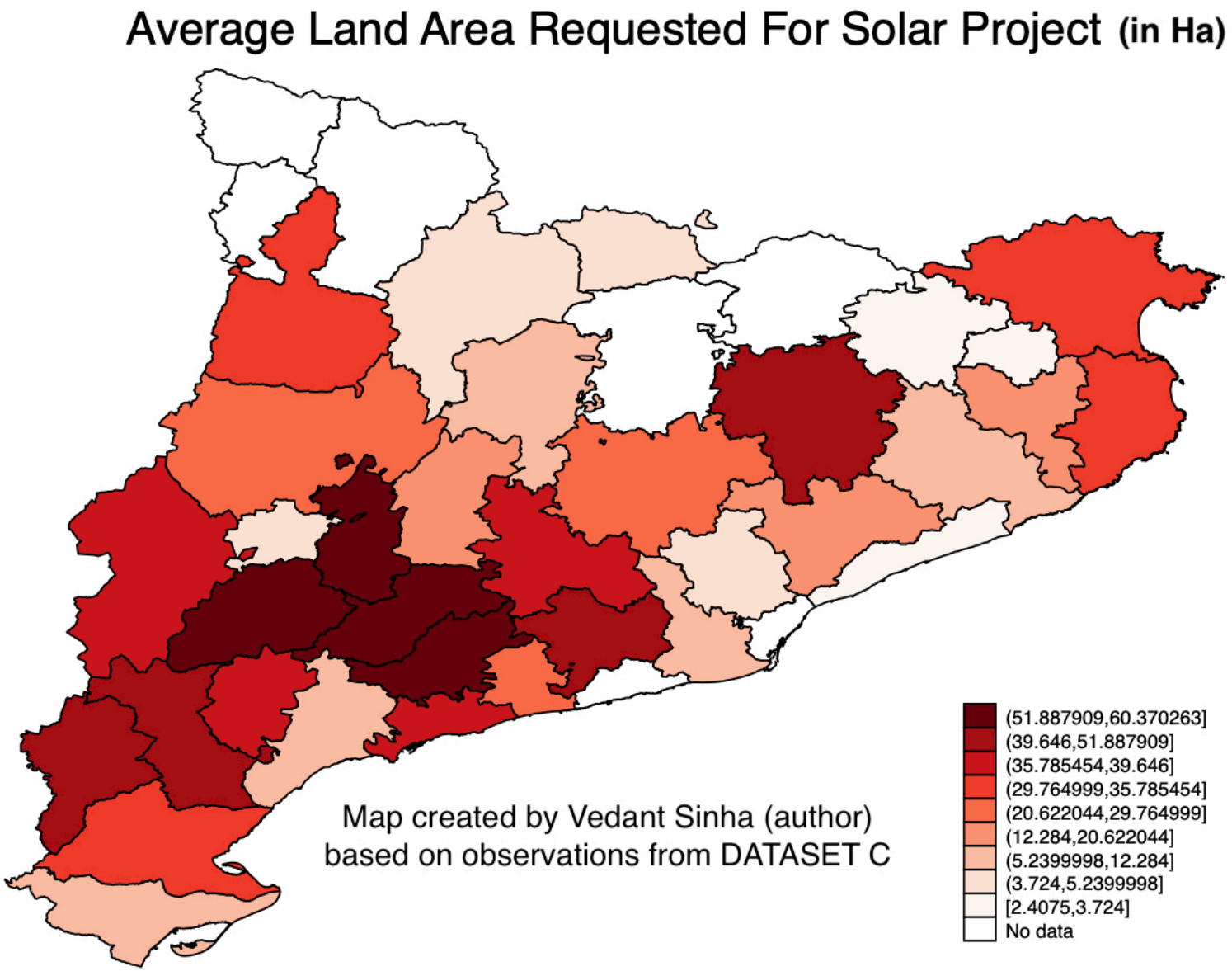
(FOR WIND)
Pairwise comparisons of means (unequal variances)

lag	Diff.	Std.Err	Dunnett's C [95% Conf.	Interval]
datenew				
2020 vs 2019	9.334311	3.734991	.3513619	18.31726
2021 vs 2019	-21.18182	1.752659	-25.73608	-16.62756
2021 vs 2020	-30.51613	3.904711	-39.90656	-21.12569

lag	Diff.	Std.Err	Games and Howell [95% Conf.	Interval]
datenew				
2020 vs 2019	9.334311	3.734991	.4492169	18.2194
2021 vs 2019	-21.18182	1.752659	-25.51345	-16.85018
2021 vs 2020	-30.51613	3.904711	-39.79271	-21.23955

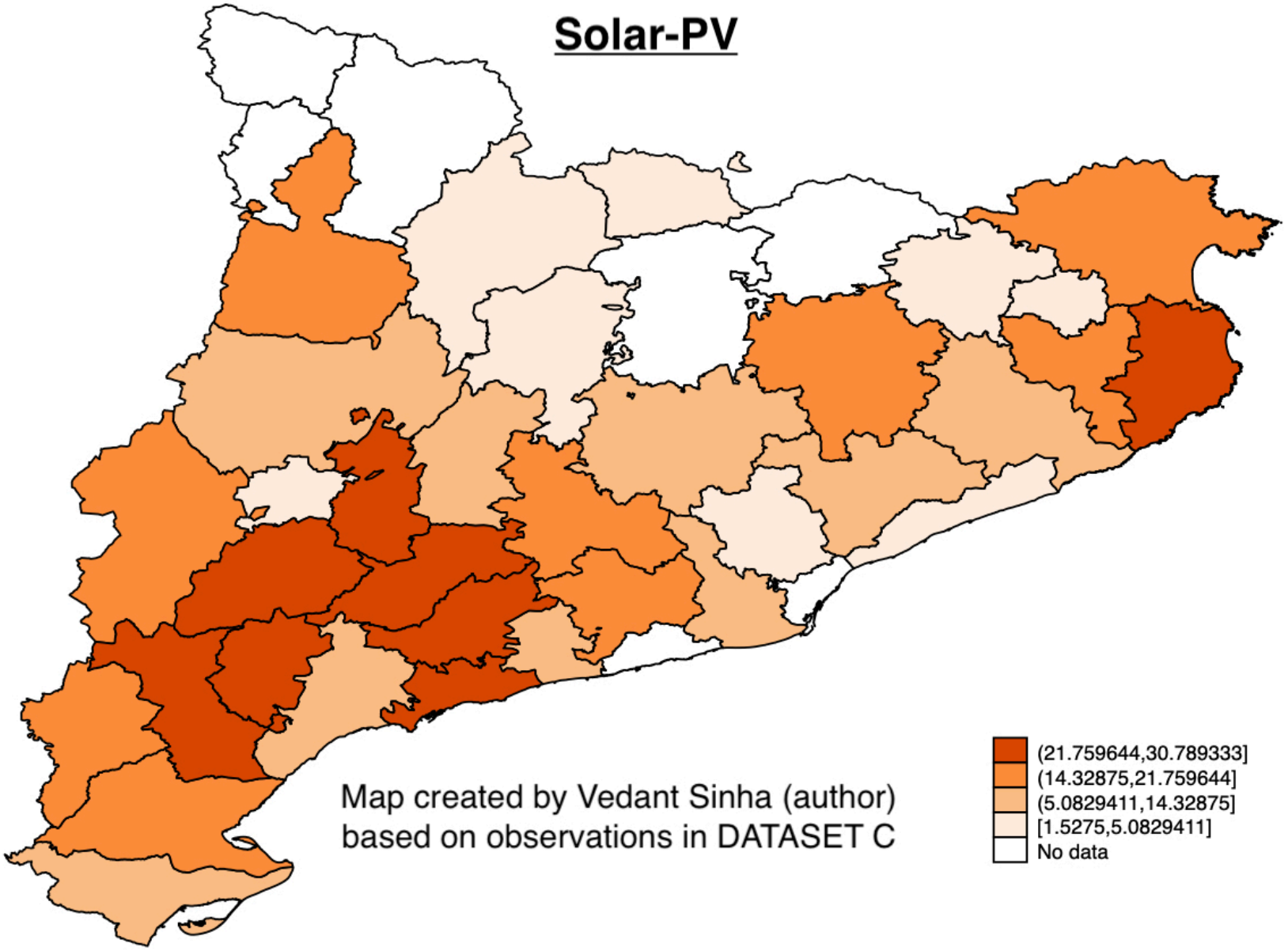
lag	Diff.	Std.Err	Tamhane's T2 [95% Conf.	Interval]
datenew				
2020 vs 2019	9.334311	3.734991	.2653074	18.40331
2021 vs 2019	-21.18182	1.752659	-25.62609	-16.73755
2021 vs 2020	-30.51613	3.904711	-39.98312	-21.04914

Annex 3A


Average Land Area Requested For Solar Project (in Ha)
Map created by Vedant Sinha (author)
based on observations from DATASET C
(51.887909,60.370263]
(39.646,51.887909]
(35.785454,39.646]
(29.764999,35.785454]
(20.622044,29.764999]
(12.284,20.622044]
(5.2399998,12.284]
(3.724,5.2399998]
[2.4075,3.724]
No data

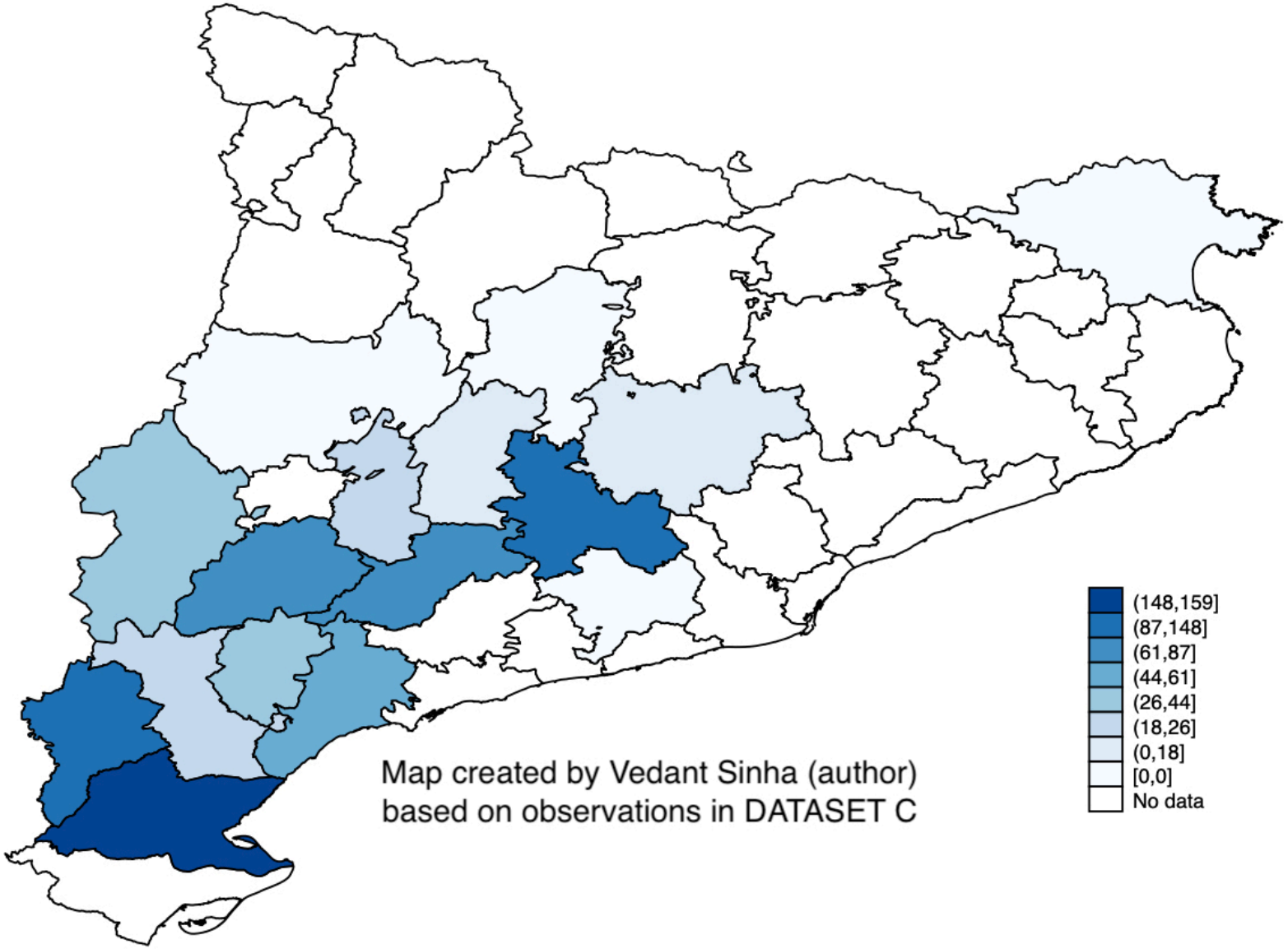
Average Production Capacity Of Installed Project (MW)

Solar-PV



INSTITUT OSTROM

Wind Turbines Already Installed



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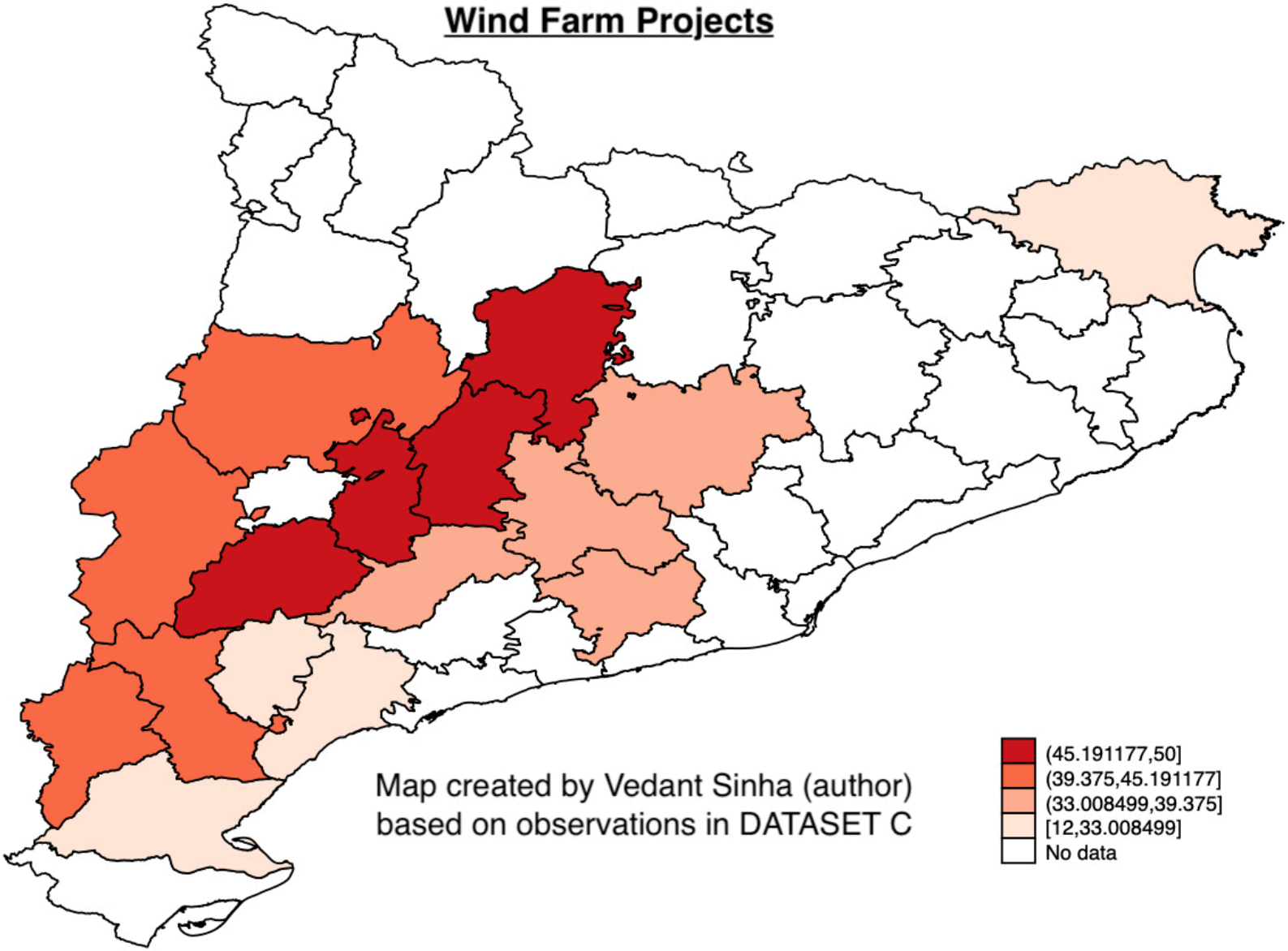
Average Production Capacity (in MW)

Wind Farm Projects



Annex 3B

Solar-PV project applications filed after the turning point of 439 days. Only 29 non-missing observations on decision delays are available for such applications.

```
. misstable summarize deldec
```

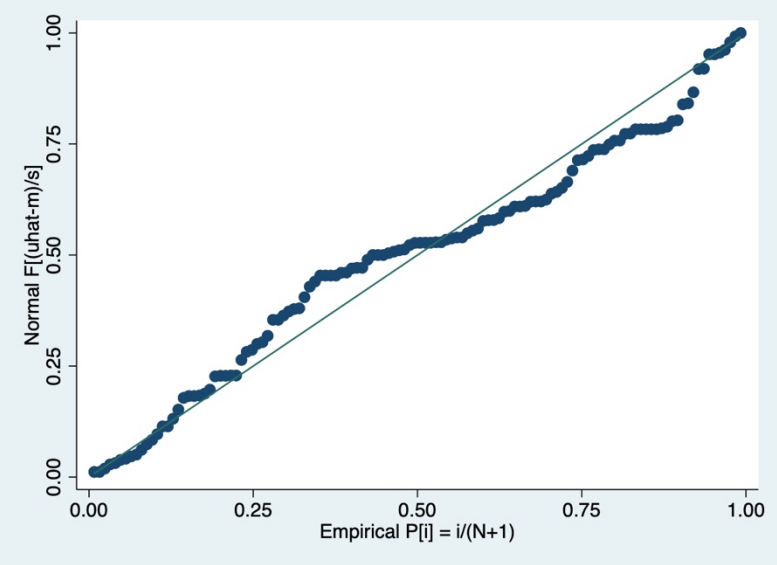
				Obs<.		
Variable	Obs=.	Obs>.	Obs<.	Unique values	Min	Max
deldec	136		29	12	47	90

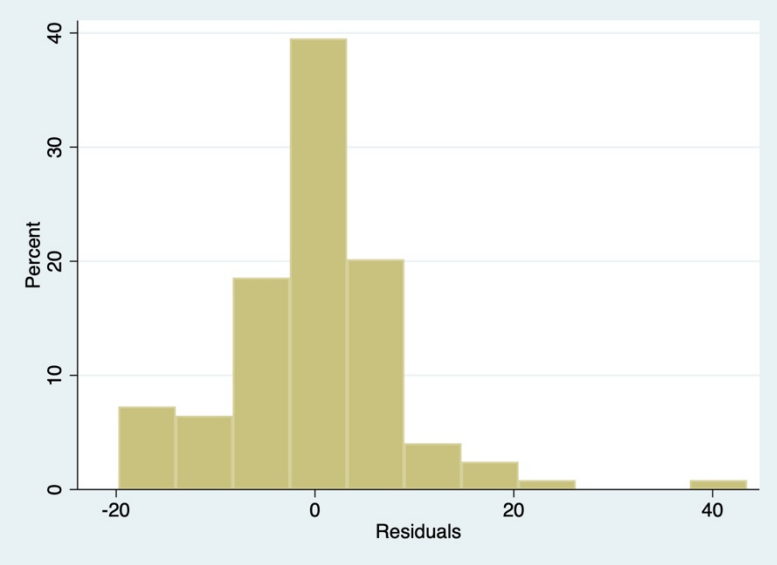
54 non-missing observations on decision times for wind project applications filed after the turning point of 268 days.

```
. sum deldec
```

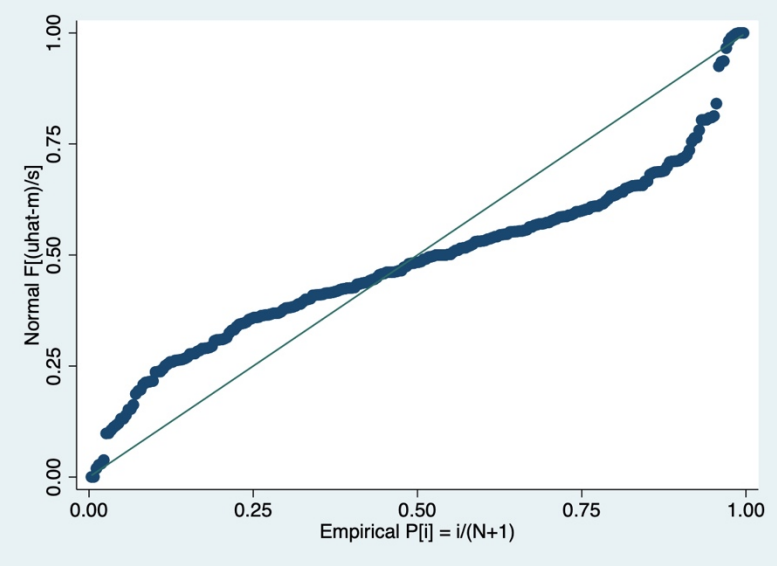
Variable	Obs	Mean	Std. dev.	Min	Max
deldec	54	80.22222	8.437711	45	94

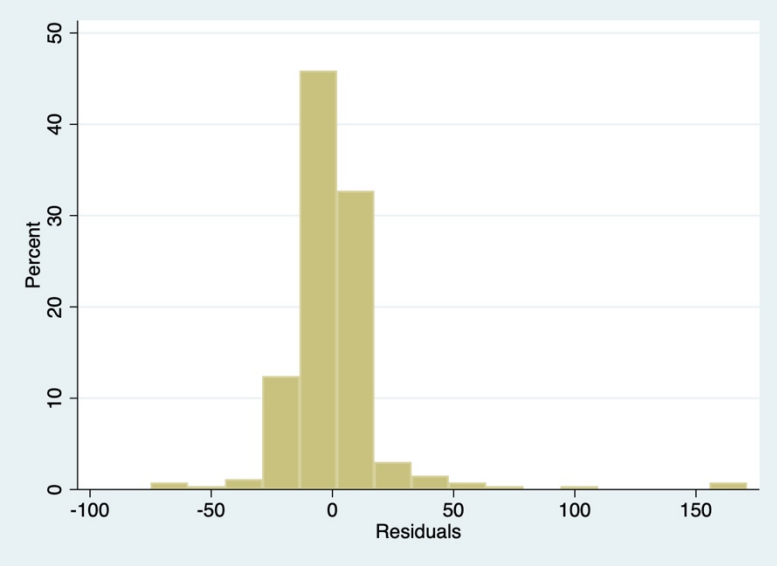
Annex 3C





For wind project model-





For solar-PV project model-

The normal probability plots and the histograms show above that the errors for both our solar-PV and wind farm project model are approximately normally distributed

---

Annex 3D

```
. pwcorr powerinmw restrixlaw turbinesinop

             | poweri~w restri~w turbin~p
-------------+---------------------------
  powerinmw  |   1.0000
 restrixlaw  |   0.0763   1.0000
turbinesinop |  -0.0908  -0.0501   1.0000
```

```
. pwcorr restrixlaw powerinmw landarea

             | restri~w poweri~w landarea
-------------+---------------------------
 restrixlaw  |   1.0000
  powerinmw  |   0.1059   1.0000
   landarea  |   0.0989   0.8992   1.0000
```

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Annex 3E

For wind project. The dategap variable represents the time that passes (in days) between the filing of two successive applications. The smaller the time gap between two applications, an old and a new one, the higher would be the workload and backlog of government bodies processing those applications.

```
dategap                                                          (unlabeled)

                Type: Numeric (float)

               Range: [0,40]                        Units: 1
      Unique values: 20                         Missing .: 1/124

                Mean: 3.78862
           Std. dev.: 6.88102

         Percentiles:     10%       25%       50%       75%       90%
                            0         0         0         6        13
```

```
dategap                                                          (unlabeled)

                Type: Numeric (float)

               Range: [0,15]                        Units: 1
      Unique values: 16                         Missing .: 1/402

                Mean:  1.5187
           Std. dev.: 2.59428

         Percentiles:     10%       25%       50%       75%       90%
                            0         0         0         2         4
```

Annex 3E

Wind Model full table

```
Linear regression                               Number of obs     =        124
                                                F(18, 102)        =          .
                                                Prob > F          =          .
                                                R-squared         =     0.9273
                                                Root MSE          =     9.5567

------------------------------------------------------------------------------
             |               Robust
      deldec | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
  restrixlaw |  -1.072155   .0667205   -16.07   0.000    -1.204495   -.9398153
 quadrestrix |   .0017633   .0001553    11.35   0.000     .0014553    .0020714
 turbinesinop |   .4474756   .2662776     1.68   0.096    -.0806848     .975636
    quadturb |  -.0020176   .0016447    -1.23   0.223    -.0052799    .0012448
  powerinmw |  -.6121404   .4232165    -1.45   0.151    -1.451588    .2273076
   quadpower |   .0093501   .0064123     1.46   0.148    -.0033687     .022069
             |
    location |
 Alt Penedès |    9.92347   6.149091     1.61   0.110    -2.273222    22.12016
       Anoia |  -10.92578   6.413519    -1.70   0.092    -23.64696    1.795409
       Bages |    1.92803   3.324511     0.58   0.563    -4.666122    8.522181
   Baix Camp |  -12.80927   8.508076    -1.51   0.135      -29.685    4.066463
   Baix Ebre |  -11.22812   5.791327    -1.94   0.055    -22.71519     .258952
Conca de Barberà |  -9.585641   8.272523    -1.16   0.249    -25.99415    6.822869
   Garrigues |  -6.832387   7.948855    -0.86   0.392     -22.5989     8.93413
     Noguera |   6.254489    6.27136     1.00   0.321    -6.184724     18.6937
     Priorat |  -10.64926   5.708908    -1.87   0.065    -21.97285    .6743287
Ribera d'Ebre |   6.921531   4.727849     1.46   0.146    -2.456136     16.2992
     Segarra |   4.604729   4.660298     0.99   0.325    -4.638951    13.84841
      Segrià |    2.06601   5.230005     0.40   0.694     -8.30768     12.4397
    Solsonès |  -.2890543   6.471086    -0.04   0.964    -13.12442    12.54631
  Terra Alta |           0  (omitted)
      Urgell |           0  (omitted)
             |
     datenew |
        2020 |   138.0631   5.483324    25.18   0.000      127.187    148.9393
        2021 |   102.9888   6.314202    16.31   0.000     90.46461     115.513
             |
       _cons |   96.43695   7.454863    12.94   0.000     81.65027    111.2236
------------------------------------------------------------------------------
```

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Solar-PV Model

Linear regression

Number of obs	266
F(36, 225)	.
Prob > F	.
R-squared	0.5596
Root MSE	23.747

deldec	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
powerinmw	.1860426	.8260271	0.23	0.822	-1.441696	1.813781
quadpower	-.0065614	.0110529	-0.59	0.553	-.0283418	.015219
landarea	-.0653808	.3137449	-0.21	0.835	-.6836351	.5528734
quadlandarea	.0007447	.0014106	0.53	0.598	-.0020349	.0035243
restrixlaw	-.8785809	.1619558	-5.42	0.000	-1.197725	-.5594367
quadrestrix	.0013459	.0002875	4.68	0.000	.0007793	.0019124
location						
Alt Empordà	-13.56887	5.805878	-2.34	0.020	-25.00972	-2.128015
Alt Penedès	1.472279	3.964817	0.37	0.711	-6.340644	9.285202
Alt Urgell	.4088271	7.527289	0.05	0.957	-14.42417	15.24183
Anoia	-5.250082	5.220072	-1.01	0.316	-15.53656	5.036401
Bages	.4973076	4.513211	0.11	0.912	-8.396261	9.390876
Baix Camp	-7.287811	5.158941	-1.41	0.159	-17.45383	2.878208
Baix Ebre	-3.763875	3.712682	-1.01	0.312	-11.07995	3.5522
Baix Llobregat	2.569615	12.93527	0.20	0.843	-22.92015	28.05938
Baix Penedès	-3.253485	4.515161	-0.72	0.472	-12.1509	5.643925
Cerdanya	-10.85674	4.516303	-2.40	0.017	-19.7564	-1.957077
Conca de Barberà	6.095682	4.262157	1.43	0.154	-2.303168	14.49453
Garrigues	5.118873	3.854348	1.33	0.185	-2.476365	12.71411
Garrotxa	-85.83584	20.83899	-4.12	0.000	-126.9004	-44.77129
Gironès	-40.28623	9.121548	-4.42	0.000	-58.26082	-22.31164
Maresme	.806951	4.205124	0.19	0.848	-7.479513	9.093415
Moianès	-23.00398	8.43462	-2.73	0.007	-39.62493	-6.383023
Montsià	-9.723511	16.96871	-0.57	0.567	-43.16143	23.7144
Noguera	.1546365	7.034368	0.02	0.982	-13.70703	14.0163
Osona	-2.73995	7.682369	-0.36	0.722	-17.87854	12.39865
Pallars Jussà	9.114916	6.388073	1.43	0.155	-3.473186	21.70302
Pla d'Urgell	28.13161	40.98937	0.69	0.493	-52.64055	108.9038
Pla de l'Estany	-26.64214	7.217982	-3.69	0.000	-40.86563	-12.41865
Priorat	-9.795503	5.561366	-1.76	0.080	-20.75453	1.163522
Ribera d'Ebre	6.204813	9.294224	0.67	0.505	-12.11004	24.51967
Segarra	-13.00125	5.874599	-2.21	0.028	-24.57753	-1.424984
Segrià	1.570026	4.182681	0.38	0.708	-6.672212	9.812265
Selva	-19.34814	7.918523	-2.44	0.015	-34.95209	-3.74419
Solsonès	.451848	5.850709	0.08	0.939	-11.07734	11.98104
Tarragonès	-8.756682	4.787092	-1.83	0.069	-18.18995	.6765873
Terra Alta	-2.220539	3.182613	-0.70	0.486	-8.492079	4.051001
Urgell	-2.258106	5.573511	-0.41	0.686	-13.24106	8.72485
Vallès Oriental	-2.028232	4.318234	-0.47	0.639	-10.53759	6.481122
datenew						
2020	47.57517	23.52487	2.02	0.044	1.217925	93.93241
2021	29.97618	22.48579	1.33	0.184	-14.3335	74.28586
_cons	179.1222	21.17868	8.46	0.000	137.3883	220.8561

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Annex 3F

```
Linear regression                               Number of obs     =        123
                                                F(20, 99)         =          .
                                                Prob > F          =          .
                                                R-squared         =     0.9313
                                                Root MSE          =     9.4253
```

deldec	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
restrixlaw	-1.075396	.0643327	-16.72	0.000	-1.203046	-.9477462
quadrestrix	.0017688	.0001489	11.88	0.000	.0014734	.0020643
turbinesinop	.3208294	.2549896	1.26	0.211	-.1851253	.8267841
quadturb	-.0012207	.0015552	-0.78	0.434	-.0043067	.0018652
powerinmw	-.6272191	.4411419	-1.42	0.158	-1.50254	.2481022
quadpower	.009889	.0065305	1.51	0.133	-.0030689	.0228469
dategap	-.5481272	.4112315	-1.33	0.186	-1.3641	.2678454
quaddategap	.0105552	.0162656	0.65	0.518	-.0217193	.0428296
location						
Alt Penedès	7.534995	5.942971	1.27	0.208	-4.257149	19.32714
Anoia	-7.365766	6.021606	-1.22	0.224	-19.31394	4.582407
Bages	1.261214	3.161044	0.40	0.691	-5.010984	7.533412
Baix Camp	-8.329844	7.738161	-1.08	0.284	-23.68403	7.024347
Baix Ebre	-11.30707	5.544749	-2.04	0.044	-22.30905	-.3050837
Conca de Barberà	-5.33006	7.59703	-0.70	0.485	-20.40422	9.744096
Garrigues	-2.661374	7.977534	-0.33	0.739	-18.49053	13.16778
Noguera	4.582527	6.455422	0.71	0.479	-8.226431	17.39148
Priorat	-8.680212	5.728073	-1.52	0.133	-20.04595	2.685528
Ribera d'Ebre	8.595999	4.514721	1.90	0.060	-.362186	17.55418
Segarra	4.750536	4.447065	1.07	0.288	-4.073405	13.57448
Segrià	4.502006	4.921293	0.91	0.363	-5.262907	14.26692
Solsonès	3.937466	8.190579	0.48	0.632	-12.31442	20.18935
Terra Alta	0	(omitted)				
Urgell	0	(omitted)				
datenew						
2020	138.5112	5.044697	27.46	0.000	128.5014	148.521
2021	103.2169	6.125673	16.85	0.000	91.06228	115.3716
_cons	98.57711	8.001041	12.32	0.000	82.70131	114.4529

The increase or decrease in backlog is represented by the dategap variable. It represents the time difference (in days) between two successive applications. It was calculated by subtracting the date of entry for two applications with one succeeding the other. A high value on dategap implies that new applications were coming in quicky and adding to the backlog because of a short time interval between new applications. From the regression table above, we can see that after controlling for a variety of factors, the dategap variable did not have a statistically significant impact on decision delay at the 0.05 significance level (represented by the deldec variable). Even after including a quadratic specific of the dategap variable, we can wee that it has no statistically significant impact on deldec at the 0.05 significance level.