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# CREATES

## Annual Report 2016

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The Danish National Research Foundation's  
Center for Research in Econometric Analysis of Time Series, CREATES



## 1. The Final Year as a DG Center of Excellence

This report is the final full year annual report of CREATES – Center for Research in Econometric Analysis of Time Series. CREATES started its activities as a DG Center of Excellence in April 2007. Following a peer-reviewed midterm evaluation during 2011, the Danish National Research Foundation decided to fund CREATES for additionally 5 years for the period April 2012-March 2017. The final evaluation report of the center was approved in the summer 2016.

The past year of the center has been a year of change and with a focus towards the final embedment of the center within the host institution, Department of Economics and Business Economics at Aarhus University. In August 2016 CREATES held its 10 year anniversary meeting at Sandbjerg Manor with participation of current and former CREATES affiliates as well as international research fellows. A part of the meeting included the annual follow up meeting with the DG board represented by Director Søren-Peter Olesen and Deputy Director Steen Marcus. This included selected scientific contributions with focus on research achievements during the 10-year funding period and CREATES Director Niels Haldrup provided a review of the embedment plans of the center.

## 2. Research

We are very pleased with the progress of CREATES and the research results that have been achieved in the funding period. Today, CREATES is one of the world's leading research centers in econometrics and according to international rankings such as RePEc, the center is placed amongst the leading institutions worldwide within the fields of econometrics and time series econometrics. CREATES is doing well along all the parameters that are considered essential for a world leading research center. This includes the training of PhD candidates, the organization of high quality seminars, workshops, and conferences, and a regular flow of distinguished visiting researchers. Most importantly, the research output at CREATES is flourishing. In 2016 almost 70 papers were published in peer reviewed journals and books and more than 50% of journal articles appeared in absolute top econometrics and finance journals including *Journal of Econometrics* (7+11 forthcoming), *Econometric Theory* (3+8 forthcoming), *Journal of Financial Economics* (1+2 forthcoming), *Journal of Applied Econometrics* (3+5 forthcoming), and *Journal of Business and Economic Statistics* (4+5 forthcoming). In total, almost 90 papers are presently forthcoming publications in peer reviewed journals and books. 33 working papers were published in the CREATES Research Paper series during 2016 and the majority of these are currently under review at journals.

Table 1 provides an updated review of CREATES publications in the most prestigious journals in our field. To date CREATES members have published almost 700 journal articles. Half of the publications are published in the very top journals.

In the final evaluation report of CREATES, which was approved by the DG board in the summer 2016, a detailed review of CREATES' research achievements were given. We will refer to that report for details including benchmarking with other research institutions. We refer to the appendix material regarding the publications of CREATES members as by 31 December 2016.

Table 1. Prioritized list of the most prestigious publication sources within CREATES' research area

#	Journal	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 Forth.**	Total
<u>General Econometrics</u>												
1	Econometrica	1	2	-	-	2	3	-	-	3	-	11
	Journal of American Statistical Association	1	-	2	1	-	-	1	-	-	-	5
2	Econometric Theory	1	1	4	3	-	1	4	4	3	3	32
	Journal of Applied Econometrics	-	-	-	1	2	2	3	4	1	3	21
	Journal of Business and Economic Statistics	2	1	1	2	1	2	2	3	3	4	26
	Journal of Econometrics	6	5	5	12	9	5	5	4	9	7	78
	Review of Economics and Statistics	2	-	-	-	-	-	-	1	-	1	8
3	Econometric Reviews	1	1	2	1	-	-	-	2	2	4	19
	Econometrics Journal	-	-	2	-	3	5	-	1	1	1	13
	Oxford Bulletin of Economics and Statistics	-	1	-	-	-	-	-	1	1	1	4
<u>Financial Econometrics</u>												
1	Journal of Finance	-	-	1	3	1	1	2	-	-	-	9
	Journal of Financial Economics	-	1	1	1	2	4	3	3	4	1	22
	Review of Financial Studies	-	1	1	2	-	1	2	-	2	-	9
2	Journal of Empirical Finance	-	1	1	2	1	2	3	7	2	3	23
	Journal of Financial and Quantitative Analysis	-	-	1	-	1	2	1	2	-	-	9
	Journal of Financial Econometrics	1	4	1	1	1	2	3	1	-	4	20
	Journal of Monetary Economics	-	-	-	1	-	-	-	-	-	-	1
	Journal of Money Credit and Banking	-	-	-	-	-	-	-	-	-	-	0
3	Journal of Banking and Finance	-	-	1	-	1	2	2	2	1	-	9
	Journal of International Money and Finance	-	-	-	2	-	-	-	-	1	-	3
<u>Statistics/Stochastics</u>												
1	Annals of Statistics	-	-	-	1	-	-	2	-	-	-	3
2	Bernoulli	-	1	1	-	2	-	2	1	-	2	12
	Finance and Stochastics	-	-	1	-	-	-	-	-	-	-	1
	Journal of Royal Statistical Society Series B	-	-	-	-	-	-	-	-	-	1	1
	Mathematical Finance	1	-	-	-	-	-	-	-	-	-	1
	Scandinavian Journal of Statistics	-	1	-	-	-	-	-	1	-	2	5
	Stochastic Processes and their Applications	-	2	4	-	-	2	1	2	2	-	16
3	Journal of Time Series Analysis	-	-	2	-	-	-	1	1	2	-	7
	Subtotal	16	22	31	33	26	34	37	40	37	37	368
	<u>Other journals</u>	16	25	18	20	27	23	43	47	39	25	315
	<b>Total</b>	<b>32</b>	<b>47</b>	<b>49</b>	<b>53</b>	<b>53</b>	<b>57</b>	<b>80</b>	<b>87</b>	<b>76</b>	<b>62</b>	<b>683</b>

\*\* Accepted (forthcoming) papers as of 1 April 2017

### 3. Research Fields and Activities

The research conducted at CREATES covers a broad range of subfields. One of the most active research areas is within the econometric analysis of high-frequency time series data, especially volatility modelling of financial data. The activity and research production is impressive and CREATES can document one of the strongest research groups worldwide in this field. Building on those competencies the area is expanding with focus on the stochastic and econometric modelling of commodity markets including energy markets. This area is one of the focus areas which is considered "high-risk" in the CREATES research plan and includes interdisciplinary research collaboration both within Aarhus University and with international research partners. The research in this area will grow in the coming years driven by recent international recruitments. Furthermore, CREATES has attracted further funding to strengthen this research field.

Other focused research fields at CREATES include theoretical time series econometrics: the analysis of non-stationary time series, long memory models, and non-linear time series modelling. Also, the fields of empirical finance, asset pricing, and housing market modelling have a very dominant priority in CREATES' research plan. A large group of researchers is attached to this field.

One particular field to emphasize here concerns the construction of statistical algorithms for econometric analysis of high-dimensional data sets. In economics and finance as well as in other research fields, the access to databases of large dimensions is becoming an increasing challenge for data analysis. In the future, CREATES will become a visible research player within the expanding field of "Big Data Analytics", especially for high-dimensional data relevant for the social sciences.

A new field on the research agenda is concerned with the analysis of climate data by use of econometrics tools. Traditionally, statistical methods have played a relatively minor role in climate research and it seems natural to combine econometric time series methods in the empirical analysis of structural climate models. A promising research collaboration with the Climate Econometrics group at University of Oxford has been initiated during 2016 and a conference with the theme of "Econometric models of climate change" was organized together with University of Oxford and hosted at CREATES in October. A special issue of *Journal of Econometrics* with selected reviewed papers from the conference will be published in 2017-2018.

CREATES has very active seminar series and regularly organizes international symposia, conferences, and workshops. During 2016 almost 50 regular lunch and invited seminar presentations were given. In addition, CREATES organized and participated in organizing four international conferences and workshops. CREATES continued its Distinguished Speaker Lectures with a lecture by Professor James G. MacKinnon from Queens University in Canada. All distinguished lectures are video recorded and are made available through CREATES' podcast archive at [www.creates.au.dk](http://www.creates.au.dk).

Domestic and international researchers contributed with a series of specialized PhD courses covering a range of fields in time series and financial econometrics.

#### 4. Organization and Future Embedment of CREATES

In our second funding period, CREATES and the host department, Department of Economics and Business Economics, moved to a new location at campus Fuglesangs Allé where the former Aarhus School of Business was previously located. The facilities being offered have been excellent. As part of the embedment of CREATES within the department by 1. April 2017 the center members will move to new locations. The past year the department has undertaken certain organizational changes. The department, which is rather big, is now organized in six different sections including a section of econometrics and a section of finance. CREATES director Niels Haldrup will head the Econometrics Section, and Professor Tom Engsted will head the Finance Section. Both section heads are part of the department management team. The two sections will be located in the same building after the move and will have excellent facilities in terms of seminar rooms in addition to other common facilities. The majority of CREATES' PhD students are also expected to be based in the same building when the move is finished in the summer 2017. Both sections will have their own budget and with continued attraction of external funding from a range of sources it is possible to maintain most of the activities at the center. Within the new organization CREATES will maintain its name and its internationally well-established brand.

As of 31 December 2016, CREATES counts a total of 28 domestic research fellows, 26 international research fellows, and 6 postdoctoral scholars. 26 PhD students are currently affiliated with CREATES.

On the administrative level, CREATES has an efficient, service-minded, and well-functioning support headed by Solveig Nygaard Sørensen. Now Solveig provides her service to both the Econometrics and the Finance sections.

#### 5. Time Development of Center Member Categories

The numbers of man-years (årsværk) of personnel affiliated with CREATES in 2016 is reported in Table 2 and supports the Appendix material. Figures 1-3 display an update of the development in man-years over the entire funding period 2008-2016 in total, for postdocs and for PhD students, respectively. In 2016 a total of 52 man-years (årsværk) were at CREATES. More than half of these are funded by the host institution and shows a significant increase during the funding period as seen in Figure 1. The main increase in man-years is due to an expanding in-take of PhD students within CREATES' research field, but also regarding positions at tenured or non-tenured level there has been a significant increase in host co-funding within the granting period in accordance with the contract agreements. Co-funding from other external sources has increased considerably over the past years and is mainly due to many externally funded postdocs even though this number has declined in the most recent years.

Table 2. CREATES affiliates and funding sources, "man-years" (årsværk), 2016

	DG/CREATES	Host institution	External fund- ing <sup>1</sup>	Other sources <sup>2</sup>	Total
<b>Domestic Research Fellows</b>	1,0	13.6	3.5	0.2	<b>18,3</b>
<b>International Research Fel- lows</b>	0.2	0.0	0.0	0.0	<b>0.2</b>
<b>Visiting Professors</b>	0.3	0.0	0.3	0.0	<b>0.6</b>
<b>Postdocs</b>	3.1	0.0	2.6	0.0	<b>5.7</b>
<b>PhD Students</b>	0.0	19.5	3.5	1.0	<b>24.0</b>
<b>Research Assistance</b>	0.9	0.3	0.6	0.0	<b>1.8</b>
<b>Support Staff</b>	1.0	1.0	0.0	0.0	<b>2.0</b>
<b>Total</b>	<b>6.5</b>	<b>34.4</b>	<b>10,5</b>	<b>1.2</b>	<b>52,6</b>

<sup>1</sup> "External funding" includes research grants from FSE (Danish Social Sciences Research Council) and Faculty Grants.

<sup>2</sup> "Other Sources" refer to salaries paid by other Danish universities to individuals affiliated with CREATES. International Research Fellows' own funding from their home institutions are not included in the figure.

Figure 1. The development in total number of "man-years" (årsværk), 2008-2016

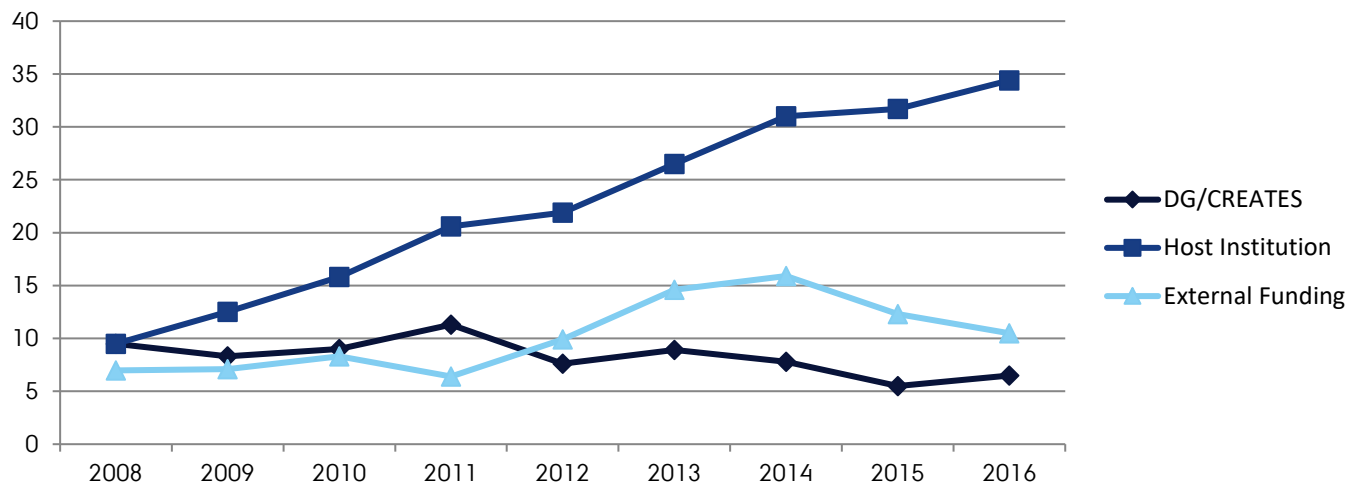


Figure 2. The development in "man-years" (årsværk) for postdoctoral candidates, 2008-2016

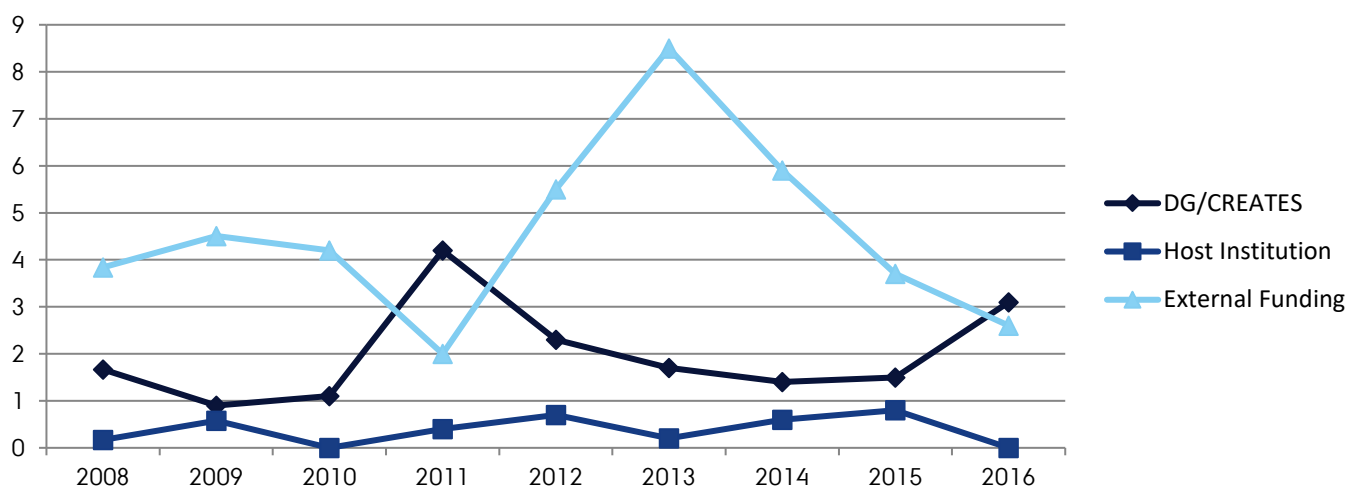
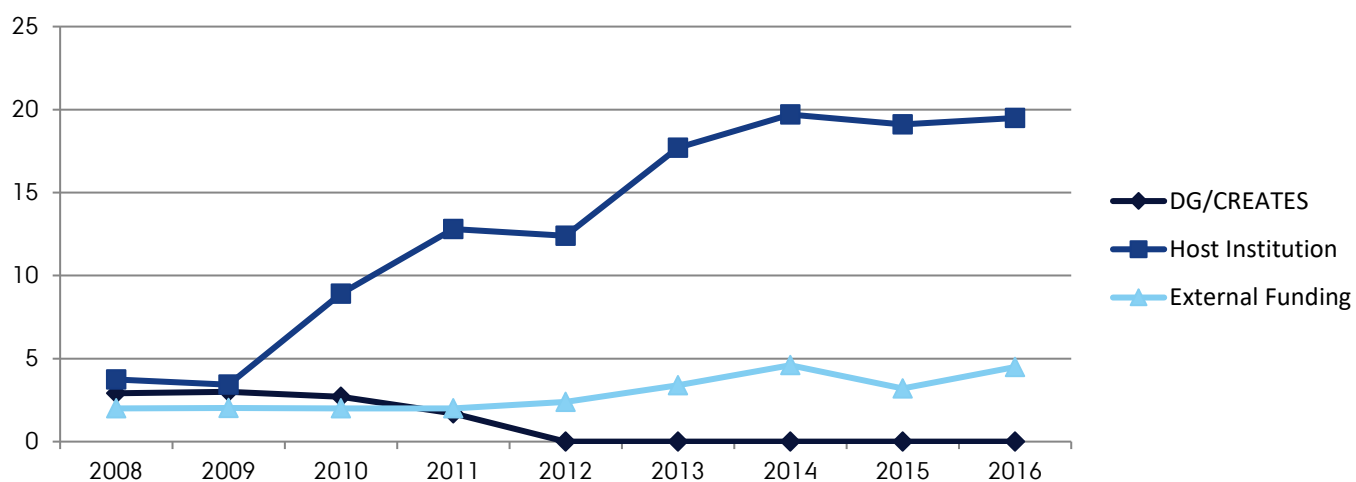


Figure 3. The development in "man-years" (årsværk) for PhD students, 2008-2016



## 6. External Funding

For the funding period 2007-2017, the Board of the Danish National Research Foundation has granted CREATES approximately DKK 80m. CREATES members have been very active in attracting additional funding from various private, public, and international sources and to date approximately 83m DKK have been granted, that is double up on the grant from the Danish National Research Foundation. A full review of external funding is given in Section D of the Appendix.

Figure 4. External funding of CREATES activities accruing to each year.<sup>3</sup>

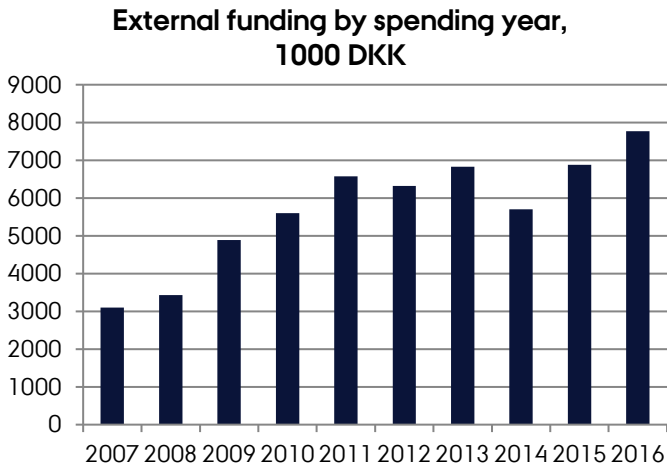


Figure 4 displays the external funding accruing to each year 2007-2016. As seen there has been a steady trend in the attraction of and spending of external funds over the lifetime of CREATES. This is very promising for the future prospects of CREATES' funding opportunities after embedment in the department.

## 7. Recruitment Strategy and Gender Strategy

### Recruitment Strategy

The recruitment policy and gender strategy in connection with openings at CREATES follow the general policy of the host institution, Department of Economics and Business Economics. Competitive openings at all levels from postdocs and assistant professorships to full professor positions are called internationally. To the extent that it is possible, calls are made with fields being as broad as possible in order to ensure the strongest possible pool of applicants. All positions with tenure and tenure-track are called at the departmental level and the final selection is a departmental management decision. For non-tenured and fixed-term positions, primarily postdoc positions, the center director in collaboration with tenured faculty of the center makes the recruitment decision.

At the postdoc and assistant professor level, international calls are coordinated with the annual North American job market conference (AEA-ASSA), which takes place in the first week of January each year. Following the call, interviews of selected candidates are made during the 3-4 days of the conference. Amongst the interviewed candidates a limited number of candidates are invited for fly-out and campus visit with the purpose of further interviews and presentation of the job-market paper of the candidates. Based on the interviews, which may also include local applicants, job offers are being given.

Often postdocs bring their own funding from external sources such as the Council for Independent Research (FSE).

### Gender Strategy

<sup>3</sup> The grant from the Danish National Research Foundation, and the 14m DKK grant to support data infrastructure are excluded in the figure.

The host institution Department of Economics and Business Economics does not have a gender strategy as such. In connection with job openings, the best candidates, regardless of gender, will be chosen amongst the qualified candidates.

Generally, the fields of economics and econometrics have an unequal gender balance, and as for other disciplines the imbalance progresses with seniority. Having said that, it is also very clear from the development over the past 15 to 20 years that the gender balance within our discipline is improving although the point of departure has been rather poor indeed.

Amongst the CREATES members based at the host institution during 2016 there is 1 female (6 males) full professor, 0 female (9 males) associate professors, 2 female (4 males) assistant professors, and 1 female (6 males) postdoc. Currently, 2 out of 28 PhD students are women. It is judged overall, however, that the ratios above are comparable with those of the host department as well as the profession as a whole even though the gender balance for the junior researchers has deteriorated compared to the previous couple of years.

## 8. Research Integrity and Good Scientific Practice

CREATES agrees upon and follows the national behavioral codex for integrity in research (“Den danske kodeks for integritet i Forskning”, Uddannelses- og Forskningsministeriet, November 2014).

In particular, we strive for ensuring a high degree of research integrity as well as schooling of good scientific practice amongst both junior and senior faculty. This task is pursued along a number of dimensions:

- Before entry to the PhD program students are offered guidance in connection with assessment work and includes instruction and guidance on literature search, proper referencing, scientific code of conduct, and actions towards plagiarism.
- Good mentoring, guidance, and teaching of students and young researchers is fundamental: A full course program at an advanced level is an integral part of the PhD program to ensure graduate students a quantitative training at the highest scientific standards upon which their own research can be based.
- PhD students are guided, mentored, and supervised by responsible advisors who are themselves active researchers.
- Where possible, young researchers (PhD students and post docs) are guided via active collaboration with senior faculty (supervisors). Even though research collaboration is encouraged, single authored work is equally important under senior supervision and guidance.
- Both junior and senior researchers are expected to present their work during in-house seminars as well as at international conferences, workshops, and symposia prior to journal submission.
- Research papers are circulated as CREATES Research Papers, at SSRN, RePEc (and similar), and distributed to domestic and foreign colleagues prior to journal submission.
- The scientific tradition in our discipline implies that the vast majority of publications are in peer reviewed journals.

Reproducibility and replication of research results are essential for good scientific practice: In principle, access to data and programming code should always be given unless legal or other limitations apply. Extended article material that is not published due to space restrictions is made publicly available via the researchers' own professional homepages.



## 9. Director's Signature

(Ved underskriften bekræftes det, at beretning og regnskab med tilhørende noter og oversigter indeholder alle relevante oplysninger, som vedrører årets primære aktiviteter i Danmarks Grundforskningsfonds Center for Tidsrækkeøkonometri.)

To my knowledge, this report and accounts including notes and entry files comprise all the information concerning CREATES (The Danish National Research Foundation's Centre for Research in Econometric Analysis of Time Series).

31 March 2017

A handwritten signature in black ink, appearing to read 'Niels Haldrup', with a horizontal line underneath.

Niels Haldrup  
Danish National Research Foundation's  
Center for Research in Econometric Analysis of Time Series, CREATES