

Doctoral researchers without appointments: who are they and how do they perform? The situation in Flanders (Belgium)

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PHD MONITORING IN FLANDERS AND THE OBSERVATION OF AN ATYPICAL GROUP

In Flanders the PhD career track is monitored for the researchers having started their PhD research since the academic year 1990-1991. This monitoring system is known as the Human Resources in Research Flanders (HRRF). As such we monitor how many researchers start a PhD track each academic year, how this population looks like with respect to gender, nationality and age, in which scientific cluster the doctoral research is carried out, how this doctoral research is being funded, to what extent they succeed in finally obtaining the PhD and how much time it takes to do so. All these results are biennially reported in the HRRF Basic indicators (1). Up to now this monitoring is only carried out for those researchers who, in addition to enrolling for the PhD, also have an 'appointment' at a Flemish university. In Table 1 of ECOOM Brief N°24 we provided some detail on these different types of appointments (2); in summary they include the competitive PhD fellows, the PhD fellows and research staff on project means, the assistants and in some cases it may concern an appointment of the remainder group. All these are considered as **doctoral researchers funded through the typical pathways**. However we note that there is a growing proportion of PhDs awarded to researchers who were never funded through these typical pathways: among the awarded PhD's in the academic year 2016-2017 it reached 17% (1). In other words, it concerns researchers who enrol for a PhD at a Flemish university, but **never** have an appointment of the type described above.

We have no structural data sources available to identify this group in detail; it may include researchers who are appointed by the academic university hospitals, non-Belgian researchers who are funded by their home institutions or by specific funding types that cannot be traced in the regular universities' staff databases (e.g. VLIR-UOS), researchers who work outside university and carry out a PhD within the framework

of their job (different from Baekeland) and researchers who carry out their research in their free time.

Flanders is not the only region dealing with this issue; it is also observed in the Netherlands, leading to an incomplete picture of the total number of PhD students (3, 4). It is indeed not easy to capture this group and in this ECOOM brief we describe the first attempt to do so.

SCOPE OF THIS BRIEF

To gain more insights into the group of doctoral researchers who were never funded through the typical pathways we use the HRRF database.

1. First, we explore to what extent we can correctly delineate these researchers using this database.
2. Next we report on the size of this group and look into its characteristics and how these compare to those of the doctoral researchers funded through the typical pathways.
3. Finally we will explore the PhD success rates of this group and compare them to those of the doctoral researchers funded through the typical pathways.

MARKING OUT DATA SOURCE AND DEFINITIONS

The HRRF database contains the appointments of all researchers associated with one of the five Flemish universities since the academic year 1990-1991. In addition, it also includes all doctoral enrolments and public defences. The latest update on which this brief is based contains the data of the academic year 2016-2017.

In this brief the doctoral researchers who were never funded through the typical pathways will be further denoted as '**without appointments**'. They will be compared to the doctoral researchers who were at least at one point in time funded through these typical pathways ('**with appointments**').

The scientific cluster in which the PhD research is carried out was determined by using the scientific cluster in which PhD enrolment occurred. In the case of more than one PhD enrolment registration the most frequently occurring cluster was chosen. When this gave rise to more than one cluster, it was put in the group 'Others', a group also containing the Arts.

The time related success rates were determined by calculating the difference between the first PhD enrolment date and the date of the public doctoral defence. This is the method used for both the group with and the group without appointments.

In the presentation of the results we will sometimes abbreviate the notation of the academic year: the academic year "2000-2001" will be shown as "'00".

Some of the results will be presented by nationality. These are grouped in the different continents (Africa (AF), Asia (AS), North-America (NA), South-America (SA), Europe, Oceania (OC)). Europe is further divided into Belgium (BE), Europe EU without Belgium (EU) and Europe non-EU (non-EU), taking into account the dates of accession to or departure from the European Union.

RESULTS

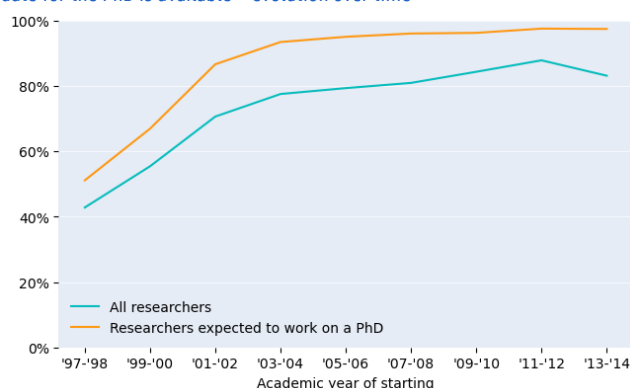
The first part of the results section deals with the methodological approach and possibilities to delineate and analyse the group without appointments. First of all we need the first PhD enrolment date to identify the start of the PhD track. We know that this information is incomplete for the older data: in the past, registration for the PhD enrolment was no obligation and there was no stimulus to enrol early during the PhD track.

So we first check when the information on PhD enrolment registration became more complete. We did this by looking at different cohorts of **researchers with a 'doctoral appointment'**, this is an appointment of the type in which one is expected to work on a PhD. The results of these analyses are shown in [Figure 1](#) and [Figure 2](#).

As can be seen in [Figure 1](#) we see that only from 2003 onwards nearly all researchers with a doctoral appointment also have a PhD enrolment registration (93%). After that, small improvements still occur; in the cohort of researchers with a doctoral appointment having started in 2013-2014 and 2014-2015, 97% also have an enrolment for the PhD. However, we are still facing the following issue: it is possible that the registration for the PhD only takes place shortly before the doctoral defence. To check this, we look at different cohorts of researchers with a doctoral appointment, and we look at when one enrolled for the first time for the PhD ([Figure 2](#)). Was this long before the first appointment (blue bars), did this take place around the period of the first appointment (grey bar) or was this long after the first appointment (yellow bars)? As shown by [Figure 2](#) the share of researchers with a doctoral appointment who enrolled for the first time for the PhD around the period of the actual start reaches 78% for the cohort starting in 2009-2010 and 2010-2011; for the older cohorts this was 70% or lower. From 2009-2010 onwards we can therefore expect that the enrolment for the PhD is sufficiently complete so that we can use this information to delineate the population of doctoral researchers. As can be seen

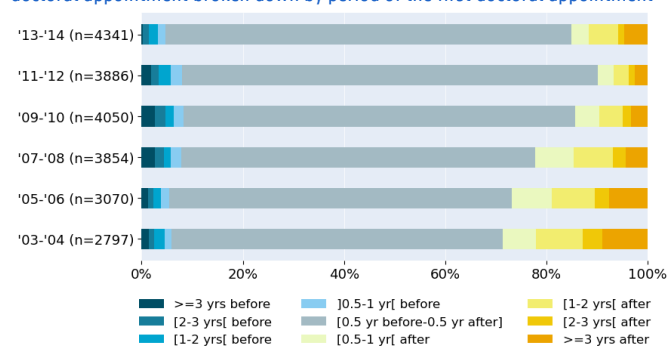
however there is still a considerable share of doctoral researchers who have their first PhD enrolment later during the PhD track (yellow part of the bars): 10% to 15%. So for calculating the success rates we need to bear in mind that we will not always have the actual starting moment. In order to calculate the PhD success rates we need at least a time span of five years after the first PhD enrolment. For this reason we limit the cohort to the doctoral researchers who enrolled for the first time for their PhD in 2009-2010, 2010-2011 and 2011-2012. For the cohort having enrolled in 2009-2010 we can provide up to seven-year success rates; for the cohort having enrolled in 2011-2012 we can provide up to five-year success rates.

Figure 1: Share of the researchers with an appointment* for whom an enrolment date for the PhD is available – evolution over time



* The orange line includes only those researchers with a doctoral appointment, this is an appointment of the type in which one is expected to work on a PhD. More specifically, these are the competitive PhD fellows, the PhD fellows and the assistants. We also added a blue line which presents all junior researchers, including those who are not necessarily working on a PhD (e.g. research staff). For more detail on the different types of doctoral appointments we refer to Table 1 of ECOOM Brief N°24 (1).

Figure 2: The moment of the first PhD enrolment relative to the start of the first doctoral appointment broken down by period of the first doctoral appointment



The blue bars represent the share where the enrolment occurred before the doctoral appointment, whereas the yellow bars represent the share where the enrolment occurred after the doctoral appointment. The grey bar represents the share where the first PhD enrolment occurred around the moment of the first doctoral appointment.

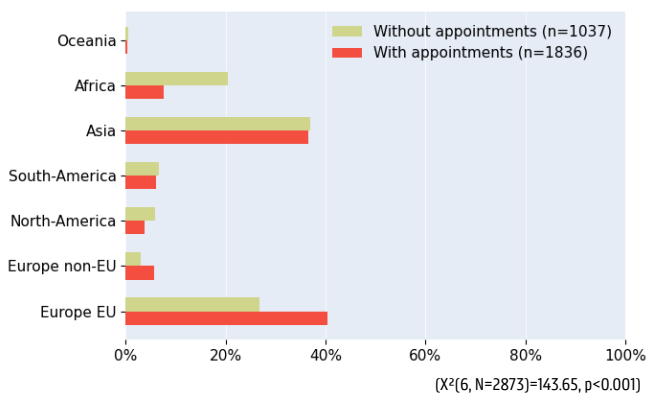
We now delineate the doctoral researchers who had their first PhD enrolment in the period 2009-2010 to 2011-2012. We count 7472 doctoral researchers. Of these 80% had an appointment at a Flemish university whereas 20% never had an appointment at a Flemish university through the typical funding pathways.

The group without appointments contained a significantly higher share of men compared to the group with appointments (60.8% versus 53.3%, $\chi^2(1, N=7472)=27.66, p<0.001$). Also the share of non-Belgians was significantly higher among the doctoral researchers without

appointments compared to those with appointments (68.7% versus 30.8%, $\chi^2(1, N=7472)=730.53, p<0.001$).

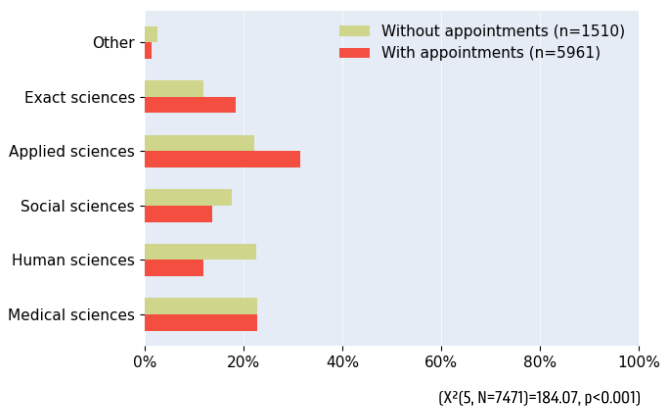
When focussing on the non-Belgian researchers we observe that the group without appointments included a significantly lower proportion of EU doctoral researchers in favour of a significantly higher proportion of African doctoral researchers. The share of Asian doctoral researchers is equally high in both groups (37%) (Figure 3). It is interesting to note that of all the African researchers who had their first PhD enrolment at a Flemish university in the period 2009-2010 to 2011-2012 (n=350) only a minority (39%) did have an appointment at a Flemish university. The closest result to this we observe for the researchers from North-America with 54%. For more detail on this, see Appendix 1.

Figure 3: Detail of the non-Belgian doctoral researchers for both those with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012



The researchers with appointments are significantly younger ($p<0.001$, Mann Whitney U) at the moment of their first PhD enrolment than those without appointments (median age is 24.7 years versus 32.0 years respectively).

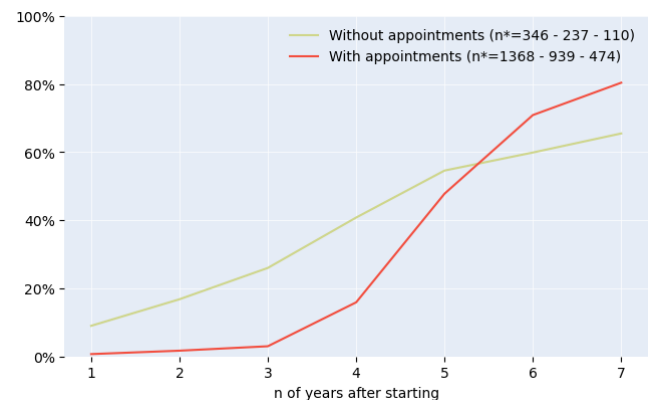
Figure 4: Scientific cluster in which the PhD is carried out for both the doctoral researchers with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012



Finally, there are some differences with respect to the scientific cluster in which the PhD is carried out (Figure 4). Compared to doctoral researchers with appointments we observe that among those without appointments there was a significantly larger share who carried out research in humanities and social sciences to the detriment of applied and exact sciences.

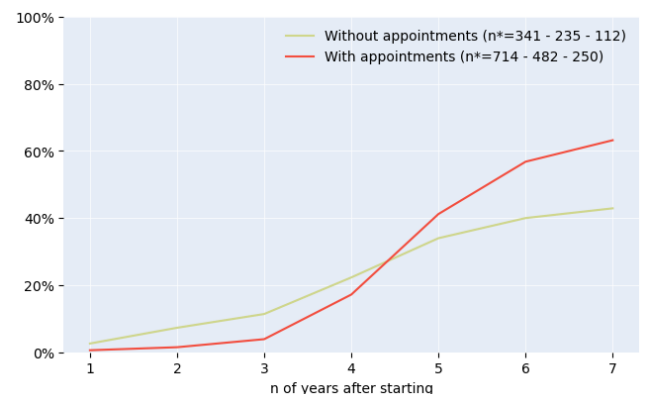
We conclude this results section with the evaluation of the PhD success rates. Globally the share obtaining the PhD within four years after the first PhD enrolment is higher in the group without appointments, but after that the situation changes and the share obtaining the PhD within five to seven years after starting is significantly higher among the doctoral researchers with appointments. We observe this for all five scientific clusters (Figure 5 to Figure 9), but in medical sciences (Figure 5) the switch occurs one year later and in social sciences (Figure 7) it occurs one year earlier. The differences are almost always statistically significant, except for the situation at four years after starting in social sciences, the situation at five years after starting in both applied and exact sciences and the situation at seven years after starting in applied sciences. The smallest difference with respect to finally obtaining the PhD is thus observed in applied sciences; the largest difference is observed in social sciences. Overall 55% of the doctoral researchers without appointments and 74% of those with appointments had obtained the PhD seven years after starting (results for the starters of 2009-2010, $\chi^2(1, N=2609)=72.59, p<0.001$).

Figure 5: The share obtaining the PhD n years after the first PhD enrolment in medical sciences for both the doctoral researchers with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012*



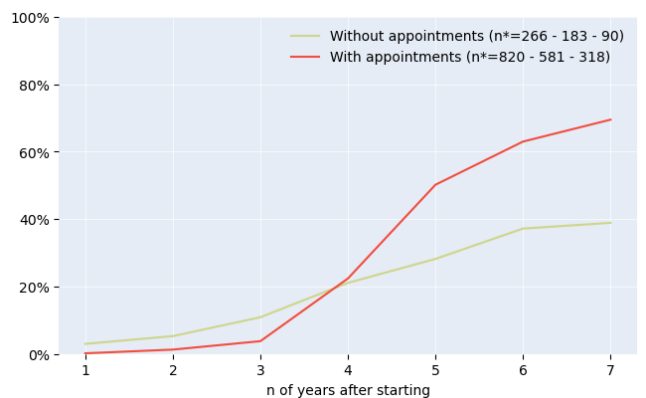
* Up to the five-year success rates we use the doctoral researchers with a first PhD enrolment in the period '09 to '11 (denominator is shown between brackets on the left); for the six-year success rates we use the doctoral researchers with a first PhD enrolment in '09 and '10 (denominator is shown between brackets in the middle); for the seven-year success rates we use the doctoral researchers with a first PhD enrolment in '09 (denominator is shown between brackets on the right). This also applies for Figure 6 to Figure 10.

Figure 6: The share obtaining the PhD n years after the first PhD enrolment in humanities for both the doctoral researchers with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012*



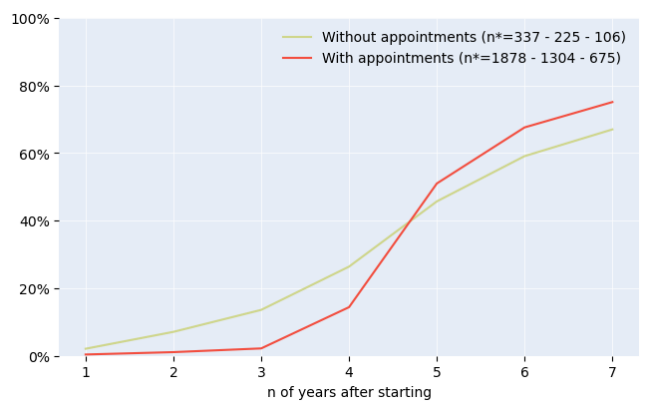
* Same as caption to Figure 5.

Figure 7: The share obtaining the PhD n years after the first PhD enrolment in **social sciences** for both the doctoral researchers with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012*



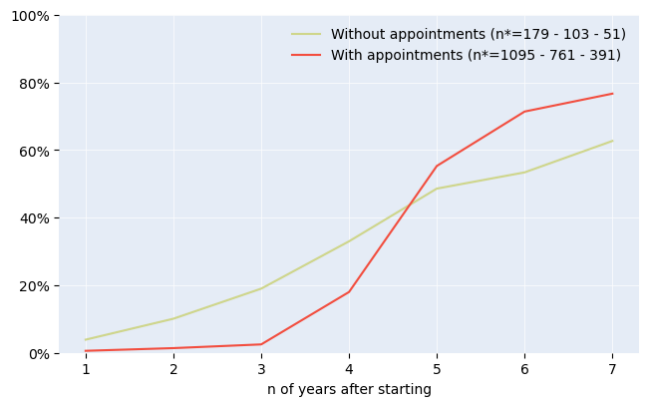
* Same as caption to Figure 5.

Figure 8: The share obtaining the PhD n years after the first PhD enrolment in **applied sciences** for both the doctoral researchers with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012*



* Same as caption to Figure 5.

Figure 9: The share obtaining the PhD n years after the first PhD enrolment in **exact sciences** for both the doctoral researchers with and without appointments - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012*

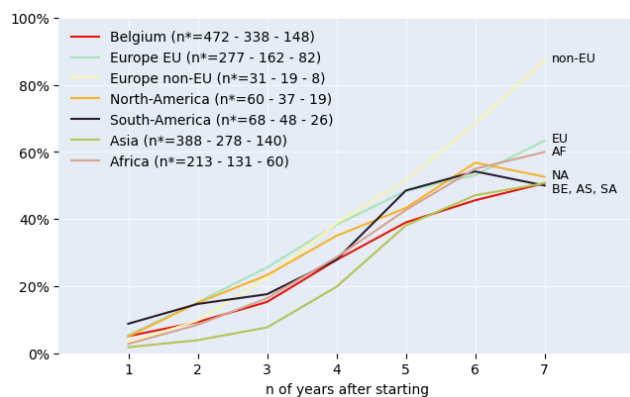


* Same as caption to Figure 5.

These results may make us wonder whether the early success rates among doctoral researchers without appointments are related to the large share of non-Belgian researchers in this group. At two, three and four years after the first PhD enrolment we indeed observe statistically significant differences between the nationalities. But these differences show lower early success rates among Asian researchers compared to

all the other regions or continents. Only researchers from the European Union have higher early success rates than the Belgian, Asian and African researchers (Figure 10). Success rates at five to seven years after starting do not differ between the nationalities.

Figure 10: The share of doctoral researchers without appointments obtaining the PhD n years after the first PhD enrolment broken down by continent of nationality - Doctoral researchers with a first PhD enrolment in 2009-2010 to 2011-2012*



* Same as caption to Figure 5.

Oceania includes only ten subjects and are added to Asia.

DISCUSSION

In this brief we had a closer look at the population of doctoral researchers who never had an appointment at the Flemish universities through the typical pathways. Through the monitoring of the PhD track using the HRRF database we have noticed for quite some time that this is a relatively large group. However, so far it has been difficult to properly delineate this group. In the current brief we describe the first attempt to do so.

First of all we need a point in time that we can use as the starting moment of the doctoral research in Flanders. For the HRRF Basic indicators (1), in which we track the careers of doctoral researchers with appointments at the Flemish universities, we determine this by combining the first PhD enrolment date and the first appointment date. For the group without appointments, the only parameter we have at our disposal to determine the starting moment is the first PhD enrolment date. We know that this information was lacking in the older data because there was no obligation to enrol for the PhD. But nowadays there is an obligation. This is confirmed by Figure 1: from 2003-2004 onwards we observe that nearly all researchers who are expected to have a PhD enrolment registration, do indeed have this registration. Although researchers are strongly encouraged to enrol for the PhD as early as possible during the doctoral process, it is sometimes still happening late, as is shown by Figure 2. But improvements have also occurred in this respect. Considering these results, it is expected that from the academic year 2009-2010 onwards we will cover nearly all doctoral researchers by using the first PhD enrolment date.

As such we have identified 7472 doctoral researchers who had their first PhD enrolment during 2009-2010 to 2011-2012 and 20% of these never had an appointment at a Flemish university through the typical pathways.

The group without appointments contained a significantly larger share of men, non-Belgians, older researchers and researchers who carried out their PhD in humanities and social sciences to the detriment of applied and exact sciences. With respect to nationality, we see that the group without appointments contains mainly Asians, EU citizens and also an important share of Africans. Here it is interesting to note that the majority of the African doctoral researchers who started a PhD at a Flemish university in this period (n=350) did not have an appointment (61%). The latter has to do with the fact that, specifically for researchers from Africa, there are more possibilities to carry out a PhD here through a specific grant, such as a VLIR-UOS grant, than through an appointment through the typical funding pathways. The results regarding age indicate that the doctoral researchers without appointments usually already had some work experience before they started their PhD. Specifically for those from the South who are an important part of the group without appointments, this is due to a combination of the higher age when obtaining their master's degree or equivalent and the time it takes to obtain the needed funding, often after being appointed for some time at a university in their home country (5). Further it is not a surprise to observe a higher share of doctoral researchers in disciplines that do not require technical equipment or support in the group without appointments.

In this brief we compared the PhD success rates of the doctoral researchers without appointments with those of the doctoral researchers with appointments. In the first group we observe a relatively high share of researchers obtaining the PhD quite soon (one to four years) after starting. This is not entirely surprising. Indeed in this group we expect to have researchers who have been doing scientific research within the framework of their paid non-academic job or during their free time and decide at some point to search for a supervisor, bundle their findings and publish it as a PhD. Researchers from abroad on the other hand may rely on a more strict time schedule due to a limited residence permit or because of financial, family or other reasons. It is also possible that some of the researchers from abroad may already be at an advanced stage of their PhD research and only depend on a Flemish university for the final phase to complete their PhD. However the results only partially support this assumption: only doctoral researchers from the European Union have higher early success rates. Asian doctoral researchers on the contrary have significantly lower early success rates.

When comparing the time related success rates it is important to bear in mind that for a small part we are not able to identify the real starting moment (yellow bars in [Figure 2](#)). Although it is very unlikely for non-Belgian researchers to enrol late for the PhD given that the PhD enrolment is often related to the residence permit, we prefer to focus on the longer term success rates, because we believe that they give a good indication of whether or not the PhD was obtained. The share having obtained the PhD seven years after starting is significantly higher among the doctoral researchers with appointments compared to those without appointments (74% versus 55% respectively). Only in applied sciences the seven-year success rates do not differ between the groups with and without appointments. The observation of overall

lower success rates among doctoral researchers without appointments is no surprise. First of all, obtaining a PhD is a time consuming and difficult process. It is a world of difference when this can be carried out in the context of a doctoral appointment, where one can concentrate almost full-time on that doctorate, where one can call upon the support of colleagues and supervisor and where there is easy access to libraries, laboratories, specific software, knowledge, etc. The latter can mainly be an issue for people who work on a PhD during their free time. Doctoral researchers from abroad on the other hand are expected to receive sufficient support in this respect, but they might be dealing with other situations that lead to a lower amount of time they can spend on the PhD. For example, the scholarships they receive are often of the 'sandwich' type, for which we know that during their stay at the home institution, researchers also have to fulfil other duties in addition to the PhD. It also occurs that the funding received from the home country is insufficient, so that additional jobs are necessary for his/her livelihood. We have to add that it is possible that the success rates in the group without appointments are an underestimation. This group might contain Belgian doctoral researchers who enrolled for the PhD and decided shortly after (within one year after first enrolment) to leave the PhD track. It would be a fairer comparison if we would only compare the subjects who had at least two subsequent PhD registrations (in year yyyy and year yyyy+1). However we do not yet have all these subsequent enrolment dates.

Also important to note is that we had to limit the success rates to seven years, given that up to now the HRRF database only includes data until 2016-2017. We know from the success rates among the population with appointments that a very low share still obtains the PhD after eight years or more and it might be possible that this share is higher in the group without appointments (e.g. non Belgians with a sandwich scholarship, researchers carrying out a PhD during free their free time). We will check this in the next updates of the database, but the older data of subjects who enrolled for the PhD for the first time in 2005-2006 (results are not shown) do not suggest that there was any catching up in the group without appointments between the eighth and eleventh year after starting.

So with these analyses we have shown that from 2009-2010 onwards we are able to monitor this population of doctoral researchers who never had an appointment through the typical funding pathways. We know how the population looks like and we know how they perform with respect to obtaining the PhD. Unfortunately we still do not know how many of these researchers carry out the PhD using home institution funding, using no funding at all, using specific funding such as VLIR-UOS, carry out the PhD within the framework of their non-academic job, ... The HRRF-database does not allow to provide an answer to this given that this database is built upon the administrative staff and PhD databases that do not contain this kind of information.

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APPENDICES

Appendix 1: Share without appointments among the doctoral researchers having a first PhD enrolment during 2009-2010 until 2011-2012 broken down by the continent of nationality

	N	% without appointments
Africa	350	60.9
North-America	130	46.2
Oceania	10	40.0
South-America	178	38.2
Asia	1054	36.4
Europe EU	1016	27.3
Europe Non-EU	135	23.0
Belgium	4598	10.3

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