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The environmental cost of the international job market for economists

Olivier Chanel*, Alberto Prati† and Morgan Raux‡

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Abstract

We provide an estimate of the environmental impact of the recruitment system in the economics profession, known as the “international job market for economists”. Each year, most graduating PhDs seeking jobs in academia, government, or companies participate in this job market. The market follows a standardized process, where candidates are pre-screened in a short interview which takes place at an annual meeting in Europe or in the United States. Most interviews are arranged via a non-profit online platform, econjobmarket.org, which kindly agreed to share its anonymized data with us. Using this dataset, we estimate the individual environmental impact of 1,057 candidates and one hundred recruitment committees who attended the EEA and AEA meetings in December 2019 and January 2020. We calculate that this pre-screening system generated the equivalent of about 4,800 tons of avoidable CO₂-eq and a comprehensive economic cost over €4.4 million. We contrast this overall assessment against three counterfactual scenarios: an alternative in-person system, a hybrid system (where videoconference is used for some candidates) and a fully online system (as it happened in 2020-21 due to the COVID-19 pandemic). Overall, the study can offer useful information to shape future recruitment standards in a more sustainable way.

Keywords: job market for economists; international job market; carbon footprint; environmental impact; comprehensive economic cost

JEL Classification: *A11; J44; Q51; Q56.*

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1 Introduction

Two years ago, Anna, a graduating PhD in Economics at Penn State University was considering a job at the University of Washington. Where did her first job interview take place? Not in Washington, not online and not even in Pennsylvania. The answer is: San Diego, California. Bart, a young economist from the University College of London (UCL), was interested in the same position as Anna. His very first interview took place in San Diego, too. And what about Colin, Bart's graduating colleague at UCL? He wanted to stay in the UK and applied for a job in Liverpool. Strangely enough, he was interviewed in San Diego, too. Anna, Bart and Colin are fictitious candidates, but that global wandering to San Diego in 2020 was not.

To be sure, the reason is not related to San Diego in particular, but to the current recruitment system in the economics profession. This system follows a standardized process, where most graduating PhDs seeking jobs in academia, government, or companies are initially pre-screened in a short interview (25-35 minutes), and subsequently invited to give a seminar at the recruiting institution for the decisive set of interviews (known as "fly-out"). Pre-screening is centralized and takes place either at the Annual Meeting of the American Economic Association (AEA) or at the Annual Congress of the European Economic Association (EEA). In January 2020, the AEA Meeting took place in San Diego, and its European counterpart took place in Rotterdam a few weeks earlier. The result was a global movement of people which produced an imprecise but momentous amount of CO₂-eq emissions and other pollutants, mainly through air transportation. The system has raised ecological concerns among some candidates and recruiters.

Even though individual responsibility plays an essential role in the ecological transition, market institutions can contribute a great deal to reducing emissions. The case of the job market for economists is paradigmatic. The use of video platforms, although technically possible, is rare. On the one hand, candidates are discouraged from asking for online interviews,

because, in doing so, they could introduce a comparative disadvantage to their competitors (recruiters tend to prefer face-to-face) and they would send a mixed signal about the number of interviews to which they have been invited at the annual meeting. On the other hand, recruiters have similar incentives to favor face-to-face interactions and to showcase their name among the list of employers. Each recruiter has a limited number of available interviews slots at each annual meeting, thus recruiters that are interested in next-door candidates might end up interviewing them on the other continent – which is what happened to Colin in our initial example. Overall, neither the candidates nor the recruiters have an incentive to deviate from the *status quo*: this is what economists would designate as an equilibrium. An ecologically unsustainable one.

The COVID-19 pandemic brought an unexpected disruption to this system. In 2020-2021, the international job market for economists was held entirely online. This event drew attention to the possibility of organizing the future recruitment standards in a more sustainable way in a post-pandemic world.

Herein, we present an original analysis and map out some potential solutions. Using a new high-quality dataset, our study estimates the environmental cost of in-person pre-screening for the 2019-20 edition of the international job market for economists. Previous research has estimated the environmental impact of academic activities. The main stream focuses primarily on the carbon footprint of conference participation ([Spinellis and Louridas, 2013](#); [Astudillo and AzariJafari, 2018](#); [Jäckle, 2019](#); [Burtscher et al., 2020](#); [Klöwer et al., 2020](#); [van Ewijk and Hoekman, 2021](#)), sometimes adding energy consumption ([Ørngreen et al., 2019](#)), time lost ([Ong et al., 2014](#)) or local pollutant effects ([Nevrlÿ et al., 2020](#)). An alternative approach uses the ecological footprint by considering the land surfaces needed to provide the goods and services necessary for the conference and to absorb the resulting waste ([Rickard, 2006](#)). The overall impact of an event (i.e. all the stages from the *ex ante* organisation to the subsequent impacts) is sometimes approached thanks to life cycle assessments ([Toniolo et al., 2017](#); [Neugebauer et al., 2020](#); [Tao et al., 2021](#)) or the ecological footprint ([Stiel and](#)

[Teuteberg, 2015](#)). Another strand of the literature considers the environmental impact of a research centre / a university / a research project as a whole and over a given period, generally through the prism of the carbon footprint ([Achten et al., 2013](#); [Arsenault et al., 2019](#); [Jahnke et al., 2020](#); [Ahonen et al., 2021](#); [Aujoux et al., 2021](#)). Finally, an article details the carbon footprint of all the stages of a scientific publication, from the early research stage to publication, with a life cycle assessment approach ([Song et al., 2016](#)).

Here, we contribute to the literature in two directions. We propose the first evaluation of an institutionalized professional job market, and we offer a comprehensive perspective by including many external costs (related to CO₂-eq and local pollutant emissions, and covering climate change, accidents, air pollution, noise, congestion, well-to-tank, habitat), as well as private costs and time lost. We contrast this overall assessment against three counterfactual scenarios: an alternative in-person system, a hybrid system (where videoconferences are used for some candidates) and a fully online system (as it happened in 2020-21 due to the COVID-19 pandemic). To clarify, our estimates refer to the pre-screening phase only: the environmental impact of the entire recruitment process (including the fly-out phase) is inevitably larger.

2 Methodology and Data

Most pre-screening interviews are organized via [Econ Job Market](#), a non-profit online platform which kindly agreed to share its anonymized data with us. The dataset includes 3,001 interviews arranged by a hundred institutions with 1,356 candidates, both at the EEA Congress in Rotterdam and the AEA Meeting in San Diego. For each annual meeting, we know the place of departure of the candidates (inferred from their IP address), the recruiters (from their institutional affiliation) and the place of arrival (conference venue). We complement the dataset with the official list of recruiters (Rotterdam) and the list of recruiters scraped from the web (San Diego), and we prudently assume each recruiting committee to be composed of only two people. Although not all interviews are arranged via [Econ Job Market](#),

we estimate that the database covers about 95% of candidates in Rotterdam and 80% in San Diego (see Supplementary Information).

Estimation details are in the Supplementary Information. The CO₂-eq emissions cover transport (by train when the travel duration is under six hours, by plane otherwise, [Jäckle, 2019](#); [Neugebauer et al., 2020](#)) and electricity consumption ([Kamiya, 2020](#)). We consider that only a fraction of the time spent in transportation is not productive (waiting, transit, transfers and boarding procedures). We compute the overall economic impact from several sources. For the external costs, a distinction is made between carbon footprint-related (climate change) and other external effects (accidents, air pollution, noise, congestion, well-to-tank, habitat). They are expressed in euro per passenger-kilometer for train and aircraft ([European Commission, 2019](#)), and in euro per kWh for electricity consumption ([European Commission, 2020](#)). Time lost in transportation is valued at the median after-tax wage rate, with different country-specific wages for recruiters and candidates ([European Commission, 2007](#); [Data Commons, 2022](#); [Indeed, 2022](#); [Payscale, 2022](#)). For private costs, we consider an average ticket price per travelled kilometer for train ([European Commission, 2016](#)) and plane ([Rome2Rio, 2018](#)), and an average expense per night for accommodations ([Where and When, 2022](#)). When in doubt, we adopt the most conservative assumption in our calculations. Hence, these figures are likely underestimating the actual environmental and economic costs.

3 Results and Alternative Scenarios

To attend pre-screening interviews at the 2019-20 AEA and EEA meetings, participants covered over 22 million kilometers, equivalent to more than 550 times the circumference of the earth. We find that the meetings generated 4,817 tons CO₂-eq. Recruiters attending the AEA meeting are twice as numerous and more often come from other continents than those attending the EEA meeting, which explains why they represent the highest CO₂-eq share (Figure 1). The total CO₂-eq emissions associated with these few days of interviews

conducted in Rotterdam and San Diego exceeds by a factor 10 the typical total emissions of these cities during the same period (Moran et al., 2018). The average individual CO₂-eq emissions of the participants were about 2.15 tons CO₂-eq per person, equivalent to one-third of the average annual carbon footprint of a European and 13% of an American (World Bank, 2021). When adding up economic costs to the monetary value of environmental externalities, we estimate the economic impact of the 2019-20 AEA and EEA meetings at €4.45 million. This is almost ten times more than if we accounted for the carbon footprint only (see Figure 1). Below, we contrast the 2019-20 situation with three alternative ways to organize the job market pre-screening phase.

Scenario 1. Doubled sessions. If all recruiters conduct interviews at both annual meetings while candidates only go to the closest meeting, the associated emissions would increase.

Many candidates attended both the American and European meetings, while most recruiters attended only the closest event. Given that there are more candidates than recruiters, it is natural to wonder if the market should rather require the latter to travel. Indeed, if all recruiters conduct interviews at both annual meetings, candidates could attend only the closest meeting. Is this a good idea? The answer is, maybe surprisingly, no. The estimated cumulated emissions, displayed in the second column of Figure 1, are even higher than in 2019-2020. This happens because not all participants - either candidates or recruiters - attend both meetings in the current system. Instead, Scenario 1 would require all recruiters to do so.

Admittedly, not all recruiters would want to attend both meetings. For instance, in 2020, many recruiters at the meetings in San Diego interviewed only American residents, in a sort of national sub-market within the international job market. However, splitting the pool of recruiters between those willing and unwilling to attend both meetings does not seem feasible in practice. Most recruiters cannot forecast the nationality of the interviewees in advance, thus making fairly complicated to decide if it is worth attending both meetings. This decision

bears important financial costs, and could discourage recruiters from offering interviews to candidates from another continent. In conclusion, Scenario 1 would not help.

Scenario 2. Hybrid. If recruiters and candidates attend only the closest annual meeting in-person, the associated emissions would be halved.

Candidates and employers would be allowed to attend only the closest job meeting in person, while they would be able to be interviewed online at the other meeting. Intercontinental air transportation represents the largest ecological and financial cost of this job market. Therefore, shrinking this entry would generate important benefits at the expense of minor adaptations of the current system. And the paradoxical case of a European institution interviewing a European candidate in the US (or the reverse) would be avoided. A criticism could be that the annual meetings host not only the job market interviews, but also international conferences where economists share their latest research. However, recruiters and candidates rarely benefit from the academic presentations at the meetings and even more rarely they participate as speakers. Other criticisms might address the fact that a hybrid format introduces an asymmetry between next-door candidates (interviewed in person) and remote candidates (interviewed online). Yet, this asymmetry is already present, in the form of pre-interview effort to join the meeting, like jet lag and financial costs. Time differences could be easily accommodated, since interviews usually take place over the course of the entire day.

Scenario 3. Fully virtual (as in 2020-21 and 2021-2022). If the entire screening process takes place online, the associated emissions would nearly be eliminated.

By far, the fully virtual scenario represents the more sustainable one, both financially and ecologically. Of course, face-to-face interaction is important and the priority of an institutionalized job market should be to generate a good match between the recruiter and the candidate. Yet, virtual pre-screening does not prevent subsequent face-to-face interaction of the shortlisted candidates at the recruiter's institution. It simply delays it to a later stage, when the probabilities of an actual match are higher. Three collateral advantages make vir-

tual interviews fairer too. First, the current recruitment system disadvantages candidates from remote areas and non-Western countries. Attendance at the annual meetings requires a considerable financial cost that only the richest sponsors can cover and that is disproportionately high for non-European and non-American candidates. Second, those with caring commitments for themselves or relatives, or with disabilities can hardly join the annual meetings. Virtual interviews would remove these financial and personal barriers (Parncutt et al., 2021; Sarabipour et al., 2021). Third, virtual interviews could be recorded and archived, allowing the recruitment committee to review them asynchronously. Research has shown that committees' fatigue (Danziger et al., 2011) and candidates' traits (Maestripieri et al., 2017) can bias the decision process, even when they should not. Recordings might prove useful for contrasting these biases.

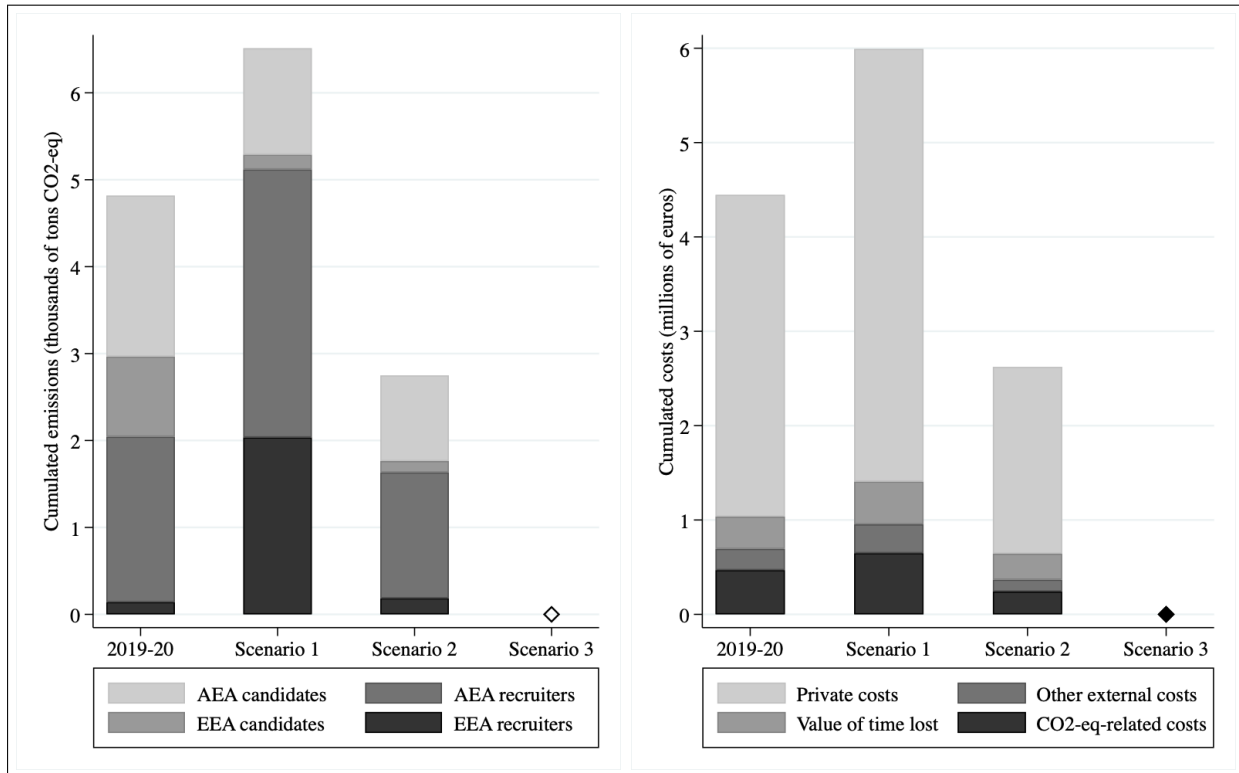
In Figure 1, the left panel details CO₂-eq emissions associated with each scenario, while the right panel presents the environmental, private and opportunity costs. The figures show that Scenarios 2 and 3 would have generated 2,749 tons and 42 kg CO₂-eq, respectively. In contrast to the €4.45 million comprehensive assessment of the 2019-20 meetings, alternative Scenarios 2 and 3 would have reduced these values to €2.62 million and €57, respectively. The largest savings are associated with travel and accommodations expenditures, and with climate-related costs.

These results highlight a beneficial aspect of the COVID-19 pandemic for this professional job market. Switching from in-person to fully virtual interviewing saved thousands of tons of CO₂-eq emissions and millions of euros for institutions. In the future, maintaining a fully virtual format would replicate this benefit annually and pave the way to a sustainable recruitment process.

4 Conclusion

Last year, the *Economist* underlined that at the 2021 AEA Meeting, held virtually, many contributions rediscussed foundational factors in the economics profession: “Just as the global

Figure 1: Overall emissions and economic assessment (by scenario).



Notes: This graph shows overall emissions and economic assessment with the pre-screening phase of the international job market for economists, for the academic year 2019-20, and compares them with three alternative scenarios. The left panel breaks down emissions across recruiters and candidates at the EEA and AEA meetings. The right panel breaks down costs between CO₂-eq-related, other externality-related, private costs and value of time lost. In Scenario 1, recruiters go to both meetings while job market candidates only go to their closest meeting. In Scenario 2, both recruiters and candidates only go to their closest meeting. Interviews that cannot be conducted in-person are conducted online. In Scenario 3, job market interviews are conducted online. Emissions and associated costs take into account return trips. **Sources:** econjobmarket.org and personal computations.

financial crisis of 2007-09 prompted a rethink of the profession’s understanding of financial markets and macroeconomic policy, the pandemic may focus attention on other blind spots” ([The Economist, 2021](#)). We believe that the ecological impact of economists’ recruitment system is one of these blind spots, and it is urgent to rediscuss it.

Urgency comes not only from the pressing challenge of climate change, but also from the role of the pandemic in disrupting institutional inertia. In some cases, the institutional arrangement is purely a matter of coordination based on a public announcer (see [Gintis, 2014](#),

chap. 2; [Guala, 2016](#), chap. 4), rather than a matter of efficiency. The international job market seems to be one of these instances. In other words, in-person pre-screening might be a stable and widespread system not because it is the best solution, but because it is a useful convention pointed out by the job market organizers.¹ Indeed, the mis-matching costs due to online pre-screening of candidates is likely to be from small to negative. This is not a claim about job interviews in general, but about the specific format of the international job market pre-screening phase, which is highly standardized, short (30 minutes) and preliminary. In this case, in-person meetings seem a focal point of coordination chosen for historical reasons, not for efficiency concerns, and the choice seems to be determined by the public announcers, which are the American Economic Association and the European Economic Association.

In 2021-22, pre-screening was held again online, saving the equivalent of about 4,817 tons of CO₂-eq and over €4.45 million, according to our estimations. This will also be the case in 2022-23, but it is unclear if the pre-screening will return to an in-person model in the post-pandemic world. Here, we presented two solutions to shape future recruitment standards in a more sustainable way.

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¹At the cost of some game theory jargon, let us be more precise. The strategic interaction between candidates and employers in the pre-screening can be understood as part of a larger game, in which the public announcer moves first and acts as Nature by pointing at one of the several possible equilibria: namely, in-person participation, which is also a Nash equilibrium. This stable (but potentially sub-optimal) equilibrium is a correlated equilibrium of the original game ([Aumann, 1974](#)). The first move of the announcer - which, crucially, is observed by all the participants - is the correlating device ([Gintis, 2014](#), p.41).

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The environmental cost of the international job market for economists

Supplementary Appendices

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July 11, 2022

A Details of the computations

A.1 Data on participants

For each annual meeting, we know the place of departure of the candidates (inferred from their IP address), of the recruiters (from their institutional affiliation) and the place of arrival (conference venue). We complement our dataset with the official list of institutions that conducted interviews at the EEA Congress in Rotterdam, as reported by the European Economic Association. We also web-scrape job postings from the American Economic Association website and include all institutions that announced their presence at the AEA Meeting in San Diego. Although not all interviews are arranged via www.econjobmarket.com, we estimate that the database covers about 95% of candidates in Rotterdam and 80% in San Diego at each meeting (see Appendix B hereafter).

A.2 Data on distance

The figures include return trips between cities of residence and cities of meetings. We use data from Google Maps to compute the distance and travel duration between pairs of cities. For rail, we use the Distance Matrix API developed by Google Maps to precisely measure the rail distance between departure and arrival railway stations. We identify the fastest train journey to reach Rotterdam or San Diego, and collect information on the exact rail distance for these trips. For plane, we compute the geodesic distance between the closest airports from residence cities and international airports of Rotterdam and San Diego, respectively. We make the conservative assumption that candidates and recruiters chose to travel by rail if the fastest train journey was shorter than 6 hours (as in [Jäckle, 2019](#); 5 hours, or [Neugebauer et al., 2020](#); 8 hours). We believe that this assumption is conservative in the sense that

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we probably under-estimate the number of plane passengers and the emissions associated with this type of transportation. For plane, we account for the fact that the great distance circle underestimates actual distance, hence actual emissions (Jäckle, 2019) mainly for three reasons. First, direct flights are not usually available and connecting flight implies another landing and take-off cycle, and a longer distance - between 20% (Klöwer et al., 2020) and 32% (Astudillo and AzariJafari, 2018). Second, even for direct flights, the great circle distance is not followed due to (expected) detours related to air routes and (unexpected) detours due to traffic, congestion and weather-driven diversions. This represents 5% to 14% longer distance for Reynolds (2014) or 14.3% for Baumeister and Leung (2021). Third, transfers between the place of residence and the airport of departure, and between the airport of arrival and conference centers, generate extra distance (with unknown transportation modes). Overall, we choose to apply a 1.2 factor to the great circle distance (as in Jäckle 2019). Finally, we make another conservative assumption by assuming that recruitment committees only include two members.

A.3 Data on emissions (see also Table 1)

For train, we consider the fastest trip between departure and arrival railway stations. We decompose the total trip into several portions, corresponding to the distance travelled in each country, and compute the CO₂-eq emissions associated with each portion. If no detailed information on the specific journey is available, we multiply the country-specific rail distance with the country average railway emission per km. When additional information on the journey is available (Thalys, Eurostar, French high-speed train and specific trains in the Paris area), we manually check which train is used for the journey, and use the specific emission information for this itinerary.

For plane, we should account for the fact that CO₂-eq emission per passenger/km are distance-dependent, and that they should cover direct greenhouse gas emissions as well as radiative forcing due to aviation-induced cirrus or altocumulus, generation of ozone by NO_x, and destruction of methane by NO_x. We rely on the best available emission calculator to date, from the Atmosfair German carbon offsetting non-profit organization (as did Klöwer et al., 2020). It provides emission estimates based on actual planes used by actual companies operating actual routes, under plausible assumptions (load factor, cargo share, economic/business split, ...) for 92% of the world traffic (Atmosfair, 2021). We compute the emissions for 30 routes between San Diego and Rotterdam on the one hand, and various capitals from countries candidates or recruiters are originated from on the other hand. We then choose the emission averages that include radiative forcing (in gCO₂-eq/km/passenger) for three classes: 225 for short-haul (<1,500 km), 205 for medium-haul (1,500-5,000 km) and 260 for long-haul (>5,000 km).

For accommodations, we do not consider CO₂-eq emissions. Although there is some evidence that the annual average energy consumption per m² in residential buildings is on average 33% lower than in hotel both in Europe and the USA (European Commission, 2021; Goldstein et al., 2020; Ricaurte and Jagarajan, 2021), too many uncertainties surround the calculations to obtain a reasonable estimate. In particular, we do not know the remaining fraction of home energy consumption while participants are at the hotel, nor the average surface per person, the type of residence, the rate of room occupancy, the number of nights spent without

additional emissions during the travel ...

We assume that an online instead of a face-to-face interview brings together one candidate with two recruiters for 30 minutes, and generates an extra consumption of 46.3 Watt-hour per hour of connection with laptop, Wi-Fi and HD video (Kamiya, 2020), hence 46.3 Watt-hour x 0.5 hours x 3 people = 69.45 Watt-hour per online interview. This leads to an average CO₂-eq emissions associated with one hour of videoconference of 9.26 grams per person (Kamiya, 2020). We do not factor in any other extra electricity consumption with respect to working from home, considering that the average energy mix of the participants in their places of residence does not significantly differ from the one in San Diego and Rotterdam.

A.4 Data on time lost

Time lost (i.e., opportunity cost of time) corresponds to the non-productive professional time related to mobility that could have been otherwise used to work. We adopt a conservative view by assuming that candidates and recruiters lose two hours of work per train trip and three hours per plane trip.

A.5 Data on economic values (see also Table 1)

Climate-related costs correspond to the costs associated with CO₂-eq emissions. Other external costs correspond to the other sources of costs associated with electricity consumption and transports (accidents, local air pollution, noise, congestion, well-to-tank, habitat). As above, we distinguish rail and air transports. For rail, we consider an average climate-related cost of €0.026 and other external cost of €0.026 per passenger kilometer (European Commission, 2019) based on electric train travel. Regarding plane, we distinguish the costs between short haul (<1,500 km), medium haul (1,500-5,000 km) and long haul (>5,000 km) because of differences in the type of aircraft, the number of passengers and the relative duration of take-off and landing phases with respect to steady flight phases. We consider average climate-related costs of €0.0426 for short haul, €0.0281 for medium haul and €0.0322 for long haul per passenger kilometer, and the average costs for other external components of €0.0187 for short haul, €0.0096 for medium haul and €0.0098 for long haul per passenger kilometer (European Commission, 2019). With regard to electricity consumption associated with online interviews, we consider the weighted external costs for climate change and other external effects per kWh for the European Union and the United States (European Commission, 2020).

For private costs directly related to participation in the job market pre-screening interviews, we assume that candidates and recruiters spend three nights at each meeting and consider an average conservative hotel price of €80 per night (Where and When, 2022). We do not account for the cost of meals taken during the conference as we assume it does not differ from the cost of meals taken at the workplace. For transport, fares depend on many country-specific parameters. However, we consider an average conservative price per passenger kilometer of €0.13 if travelers take a train (European Commission, 2016, Figure 4.12), €0.13 if they take a plane (Rome2Rio, 2018), a surprising similarity. For electricity, we use GlobalPetrolPrices (2021) to compute the average price per kWh for the 33 countries of the participants. It is based on seven data points calculated at the average annual household consumption of electricity, and at 25%, 50%, 75%, 150%, 200% and 300% of the average

consumption level. It amounts to €0.18 per kWh (in June 2021), hence €0.0082 per hour of online connection and per person.

Regarding the valuation of time lost, we obtain country-specific estimates of the average hourly wages of recruiters and candidates based on [European Commission \(2007\)](#). For the former, we consider average wages of researchers; for the latter, we consider average wages of researchers with less than four years of experience. Based on today’s typical academic wages in the UK (drawn from [Data Commons, 2022](#); [Indeed, 2022](#) and [Payscale, 2022](#)), we compute the growth rate since 2006 and apply this same linear trend to all countries. As for the few countries which were not reviewed in [European Commission \(2007\)](#), we assume a constant wage-to-GDP ratio across countries and compute average hourly wages from the following relationship at time t : $wage^{country_t} / wage^{UK_t} = GDP\ per\ capita^{country_t} / GDP\ per\ capita^{UK_t}$.

Table 2 compares total emissions and costs associated with the 2019-20 edition of the job market meetings with three alternative scenarios. In Scenario 1, we propose an alternative in-person system where all recruiters conduct interviews at both EEA and AEA meetings while candidates only go to the closest meeting. In Scenario 2, we propose a hybrid system where both recruiters and candidates only go to their closest meeting. In this second scenario, interviews that cannot be conducted in-person are conducted online. In Scenario 3, we propose a fully virtual system where all interviews are conducted online.

The first row compares the total distance covered by candidates and all recruiters in 2019-20. The second row compares associated CO₂-eq emissions. In the first three columns, CO₂-eq emissions result from candidates’ and recruiters’ journeys between their residence and conference venues. In the last column, CO₂-eq emissions result from the energy used to conduct online interviews. The third and fourth rows detail the climate-related and other external costs for each scenario. The fifth row presents the private costs associated with each scenario, which include transport (train/plane tickets and public transportation between the train stations/airports and the conference venues) and accommodations costs. The sixth row represents the valuation of non-productive professional time spent in transportation.

B Estimation of the numbers of missing candidates and recruiters in the database

Table 3 describes the available data from the Econ Job Market (EJM) database, broken down by annual meeting. The database does not contain all interviews organized during the meetings, because some recruiters could arrange interviews by email or by other platforms rather than on www.econjobmarket.org. Hence, the overall numbers of recruiters (r_{tot}) and candidates (c_{tot}) are missing, but the former can be obtained from other sources and the latter can be estimated.

We denote as “non-observed recruiters” (r_{no}) and “non-observed candidates” (c_{no}), individuals that took part in an annual meeting, but that we do not observe in the database. We denote as “observed recruiters” and “observed candidates”, the participants who are present in the EJM database. We obtain the number of non-observed recruiters from public informa-

tion on job offers and from personal communication with the EEA: 98 in Rotterdam, leading to $r_{tot}=155$, and 245 in San Diego, leading to $r_{tot}=288$.

For the estimation of the number of non-observed candidates, let's assume that the probability that a candidate is interviewed does not depend on the type of the employer (i.e., observed or non-observed in the database), and that the average numbers of interviews by recruiters (int_r) and by candidates (int_c) do not depend on their types either (i.e., observed or non-observed). The probability of not observing a candidate in the EJM database, denoted by π , corresponds to the probability that this candidate has only been interviewed by non-observed recruiters. For a candidate with x interviews, $\pi = [\Gamma(r_{no} + 1)/\Gamma((r_{no} + 1) - x)]/[\Gamma(r_{tot} + 1)/\Gamma((r_{tot} + 1) - x)]$, where $\Gamma(\cdot)$ is the gamma function.

The average number of interviews of observed candidates by observed recruiters ($int_{c_{no}}$) is known (3,001), as well as the average number int_r of interviews by recruiters. We are then looking for the average numbers of interviews per candidate (int_c) such that $(c_o/(1 - \pi)) \times int_c = r_{tot} \times int_r$, where π is defined as above with $x \equiv int_c$. By trial and error, we converge to $\pi=3.6\%$ in Rotterdam and $\pi=21.7\%$ in San Diego, meaning that the database contains 96.4% and 78.3% of candidates. The high estimated proportion of observed candidates is due to the fact that, typically, each candidate has several interviews at the meetings: as long as a candidate has one interview from an observed recruiter, s/he is observed in the database.

In our calculation, we assumed that π is computed on int_c , the average number of interviews by candidates. However, it should rely on the whole distribution of the numbers of interviews, which is unknown. When we relax this assumption by conducting sensitivity analyses on several bimodal distributions having int_c as mean value, we conclude that the EJM platform covers at least 95.5% of the candidates in Rotterdam, and 77.3% in San Diego.

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Table 1: Parameters used in computations.

Parameter	Value	Unit	Source
Emissions:			
Plane (short haul)	225	g CO ₂ -eq/passenger km	Atmosfair (2021)^a
Plane (medium haul)	205	g CO ₂ -eq/passenger km	Atmosfair (2021)^a
Plane (long haul)	260	g CO ₂ -eq/passenger km	Atmosfair (2021)^a
Train (Belgium, average)	48.4	g CO ₂ -eq/passenger km	www.bilans-ges.ademe.fr
Train (England, average)	75	g CO ₂ -eq/passenger km	www.bilans-ges.ademe.fr
Train (Europe, Eurostar)	11.2	g CO ₂ -eq/passenger km	www.sncf.com ^b
Train (Europe, Thalys)	11.6	g CO ₂ -eq/passenger km	www.sncf.com ^b
Train (France, local)	29.2	g CO ₂ -eq/passenger km	www.sncf.com ^b
Train (France, High Speed)	3.2	g CO ₂ -eq/passenger km	www.sncf.com ^b
Train (France, Transilien)	6.4	g CO ₂ -eq/passenger km	www.sncf.com ^b
Train (Germany, average)	66.8	g CO ₂ -eq/passenger km	www.bilans-ges.ademe.fr
Train (Netherlands, average)	76.3	g CO ₂ -eq/passenger km	www.bilans-ges.ademe.fr
Train (United States, average)	70	g CO ₂ -eq/passenger km	Klöwer et al. (2020) and Miller (2021)^c
Online	9.26	g CO ₂ -eq/hour	Kamiya (2020)^d
CO₂-related costs:			
Plane (short haul)	0.0239	€/passenger km	European Commission (2019)^e
Plane (medium haul)	0.0185	€/passenger km	European Commission (2019)^e
Plane (long haul)	0.0224	€/passenger km	European Commission (2019)^e
Train	0	€/passenger km	European Commission (2019)^e
Online	0.00218	€/hour	European Commission (2020)^f
Other external costs:			
Plane (short haul)	0.0187	€/passenger km	European Commission (2019)^e
Plane (medium haul)	0.0096	€/passenger km	European Commission (2019)^e
Plane (long haul)	0.0098	€/passenger km	European Commission (2019)^e
Train (average Belgium)	0.028	€/passenger km	European Commission (2019)^e
Train (average England)	0.015	€/passenger km	European Commission (2019)^e
Train (average France)	0.014	€/passenger km	European Commission (2019)^e
Train (average Germany)	0.036	€/passenger km	European Commission (2019)^e
Train (average Netherlands)	0.016	€/passenger km	European Commission (2019)^e
Train (average United States)	0.041	€/passenger km	European Commission (2019)^e
Online	0.00225	€/hour	European Commission (2020)^f
Private costs:			
Plane	0.13	€/passenger km	Rome2Rio (2018)^g
Train	0.13	€/passenger km	European Commission (2016)^h
Online	0.0082	€/hour/person	GlobalPetrolPrices (2021)ⁱ
Accommodation	80	€/night	Where and When (2022)
Value of time lost:			
Average hourly wages	See sources	€/participant	European Commission (2007)^j

Notes: This table details the values of the parameters used in our computations. ^a Average from the values obtained in atmosfair flight emission calculator (see text). ^b <https://www.sncf-connect.com/en-ch/help/calculation-co2-emissions-your-train-journey>. ^c Average from these two sources. ^d Electricity use of streaming, scenario B, and International Energy Agency global average electricity mix. ^e Table 70 for bus and electric train, Table 72 for plane. ^f Weighted average EU and US of climate cost and other effects in Table 3.1. ^g <https://www.rome2rio.com/labs/2018-global-flight-price-ranking/> ^h Average of international fares, month in advance and week in advance, Figure 4.12. ⁱ Average for the countries of the participants (see text). ^j Complemented by [Data Commons, 2022](#); [Indeed, 2022](#); [Payscale, 2022](#) and own computations (see text).

Table 2: Overall emissions and economic assessment.

	Estimations	Counterfactual scenarios		
	2019-2020	Scenario 1	Scenario 2	Scenario 3
Distance (in km)	22,026,368	30,157,262	11,911,022	0
Emissions (in kg CO ₂ -eq)	4,817,493	6,513,121	2,749,273	42
CO ₂ -eq-related costs (in €)	469,169	648,624	242,165	10
Other external costs (in €)	224,572	304,625	125,626	10
Private costs (in €)	3,409,988	4,584,368	1,980,080	37
Value of time lost in transportation (in €)	342,283	454,625	275,086	0
Overall economic assessment (in €)	4,446,012	5,992,241	2,622,957	57

Notes: This table compares the estimated costs associated with the International job market for economists for the academic year 2019/2020 with 3 counterfactual scenarios. In Scenario 1, recruiters go to both meetings while European and non European job market candidates respectively go to the European/American meeting. In Scenario 2, European (non-European) recruiters and candidates only go to the European (American) meetings. Interviews between European (non European) candidates and non European (European) recruiters are conducted online. In Scenario 3, job market meetings are conducted online. Emissions and associated costs take into account return trips. The overall economic assessment sums up private, opportunity, CO₂-eq-related and other external costs. **Sources:** econjobmarket.org and authors' computations.

Table 3: Interviews, candidates and recruiters in EJM and complementary data

Job market meeting:	Rotterdam	San Diego
Number of interviews: (observed in EJM database)	1,720	1,281
Number of candidates: (observed in EJM database)	637	719
Number of recruiting institutions: (observed in EJM database)	57	43
Number of recruiting institutions (r_{no}): (not observed in EJM database)	98	245
Total number of recruiting institutions (r_{tot}):	155	288

Notes: This table presents the number of interviews, candidates and recruiting institutions observed in Econ Job Market (EJM) data. It also includes the number of recruiting institutions who conducted interviews at Rotterdam (San Diego) but that are not included in the EJM database. For Rotterdam, we obtained this information from personal communication from the European Economic Association. For San Diego, we obtained this information from vacancies advertised on the website of the American Economic Association. **Sources:** econjobmarket.org, European Economic Association, American Economic Association.