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The Social Roots of Expertise: Evidence from the IMF

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How do institutions develop expertise in emergent issues? Scholars emphasize topdown professional incentives as a source of expertise acquisition by bureaucracies. We argue that in issue areas marked by intra-institutional discord — where principals send conflicting signals on the value of issue-specific expertise — horizontal socialization across staff instead drives expertise acquisition. We develop this argument in the context of climate change, where principal preferences often diverge or fluctuate. Empirically, we use original data on the composition of Article IV mission teams at the International Monetary Fund, social contacts between thousands of IMF staff, and the contents of IMF policy recommendations issued from 2004–2019. Analyses indicate that intra-staff interactions accelerate bureaucrat learning: staff who work alongside climate-attuned colleagues subsequently issue higher quality advice than staff with professional networks less focused on climate. These findings offer a new social account of bureaucratic expertise and institutional change, and shed light on the sources of effective climate governance.

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Political scientists often view institutions as rigid and path dependent, with a sluggish pace of reform in the short term (Riker 1980). Scholars have historically attributed institutional change to powerful and infrequent exogenous shocks, such as wars or pandemics (Krasner 1976; Wallander 2000; Young 2010; Colgan, Keohane, and Van de Graaf 2012).¹ Contributing to institutional inflexibility is bureaucratic homogeneity. When the individuals that staff institutions share similar worldviews, it leaves little space for new ideas to take hold (Weaver 2008). Institutions reinforce this homogeneity by hiring staffers with shared educational and demographic characteristics (Chwieroth 2015; Nelson 2017) and by strictly monitoring bureaucrat behavior (Honig 2018, 2019).

Yet institutions sometimes reorient their policymaking around emergent issues (Jupille, Mattli, and Snidal 2013). Climate change is a prime example. Over the last decade, a diverse and growing set of generalist political institutions — those founded for reasons distinct from climate and the environment — have sharpened their rhetorical and material focus on the issue. Such pivots in rhetoric and policymaking to climate have been particularly pronounced in the domain of global economic governance, where institutions ranging from the IMF and World Bank to domestic financial regulators have sought to incorporate climate into their operations and devoted new resources to climate policymaking (Quorning 2023).

Recent work attributes attention to climate to learning by individual bureaucrats exposed to climate shocks (Clark and Zucker 2024). But in order to effectively govern in the climate space, institutions additionally need bureaucratic *expertise* in the issue: individuals with technical knowledge of climate and decarbonization.² Theorists of political institutions sometimes take expertise as a given, assuming technocratic bureaucracies to enjoy

¹Though incremental reforms can be pursued absent such shocks (Blyth 2002; Lipscy 2015; Carnegie and Clark 2023).

²Bureaucratic expertise is regarded as necessary for high-quality policy choice and implementation (Gailmard and Patty 2012).

ample issue-specific expertise (e.g., Huber and Shipan 2002). But the novelty of climate as a primary political issue makes it difficult to assume innate expertise, as does the technical complexity of various forms of climate policymaking and analysis (Stokes 2020; Condon 2023; Hai 2024). While institutions may look to hire new staff to supply this expertise, they are constrained in their ability to do so successfully by a shortage of climate experts available for hire and increased competition for their services from the private sector (Singh, Thrall, and Zucker 2025). Moreover, mission-oriented climate experts may prefer to work for more climate-forward institutions,³ rather than institutions primarily dedicated to other goals. Indeed, a recruitment drive at the IMF has been complicated by "the limited number of climate economics experts worldwide and [the fact] that the Fund is not alone in its quest to employ them" (Committeri et al. 2022, fn. 11).

This paper asks how political institutions acquire expertise in complex and novel policy domains, with a focus on climate change. Given the aforementioned constraints on hiring external experts, we consider how existing in-house bureaucrats may obtain climate expertise. Prominent accounts link expertise acquisition by bureaucrats to incentives imposed from the top down. Gilligan and Krehbiel (1987) and Gailmard and Patty (2007) notably argue that bureaucrats invest in obtaining the expertise needed to choose good policies only when granted adequate policymaking discretion by principals (Gailmard and Patty 2007). While plausible in the context of climate, disagreement among political principals — common in international organizations (Clark and Zucker 2024) — or fluctuations in principals' attitudes towards climate suggest that bureaucrats may receive inconsistent signals on the value of considering climate in their work.

This paper instead introduces a complementary theory of expertise acquisition that focuses on interactions among bureaucrats at the same institution. Work on domestic and international bureaucracies typically focus on how staff interact with counterparts *external* $\overline{}^{3}$ See Honig (2024). to their institution, such as legislators (Huber and Shipan 2002), interest groups (Thrall 2023), and foreign officials (Malis 2021). There has been less attention to the professional networks present within institutions and consideration of how they might affect bureaucrat attitudes, behavior, and, in turn, institutional performance.

We argue that *intra-staff interactions* generate expertise for institutions. Bureaucrats do not work in isolation within their institutions. Rather, they are frequently assigned to work in teams with colleagues. Examples abound. To survey member state economies, the IMF assembles small "Article IV mission teams" with staff drawn from across departments. Team members travel to member states, collect and review information, and issue policy recommendations to host governments. The World Bank and other development banks organize small task teams to manage development projects and consult with stakeholders on the ground. The World Health Organization sends emergency medical teams to support local health systems amid disease outbreaks. The European Central Bank monitors individual financial institutions via small supervisory teams of in-house experts. In all such cases, team members work alongside each other to collect and interpret information, apply institutional rules and procedures, and deliver services. We theorize that the presence of climate-attuned bureaucrats on a team — staff attentive to climate change — supports expertise acquisition by team members, a diffusion-like process that can ultimately produce aggregate improvements in institutional knowledge and performance.

Our empirical focus is the IMF, an institution that functions as a key source of economic expertise for policymakers. To test the theory, we compile original data on the personnel makeup of Article IV mission teams, the professional networks of thousands of IMF staff, and the content of nearly 8,500 policy recommendations issued by the Fund to national governments between 2004 and 2019. We use the lexical complexity of policy recommendations to measure contributing bureaucrats' level of expertise.

We first document that levels of climate expertise across the IMF have increased over

time, with climate-related recommendations approaching the level of sophistication that characterizes Fund advice in other domains. Climate-related policy recommendations in 2019 are estimated to be 33% more sophisticated than they were a decade prior. We similarly document that individual IMF bureaucrats appear to acquire greater expertise during their time at the Fund. In line with our theory, we find that intra-staff interactions accelerate these processes of expertise acquisition. Bureaucrats contribute meaningfully more sophisticated climate recommendations when they were assigned to work with more climate-attuned colleagues earlier in their careers. Bureaucrats who previously worked with few climate-attuned coworkers issue climate policy recommendations that are substantially less sophisticated than the recommendations they render in other areas.

These findings contribute to several literatures. First, they build on a growing body of work that emphasizes preference heterogeneity within international (Heinzel, Weaver, and Jorgensen 2024; Kentikelenis, Lang, and Wellner 2024) and domestic bureaucracies (Schub 2022; Jost 2023; Carcelli 2024). While this literature has identified how such heterogeneity can initially emerge (Clark and Zucker 2024), it has less to say about how it evolves: whether bureaucracies remain divided attitudinally, converge to common understandings of given issues, or resolve to some other distribution of preferences. This paper sheds light on this process, suggesting that regular interactions between staff — in particular, the practice of assigning bureaucrats to work on small teams — serve as conveyor belts for disseminating attitudes and competencies across large bureaucracies.

The results also speak to research on the sources of institutional change and bureaucratic expertise. Conventional wisdom suggests that institutions are slow to reform, with change being dictated from the top down (Nielson and Tierney 2003; Lipscy 2015; Kaya 2015; Copelovitch and Rickard 2021). We illustrate how novel ideas can take root in the middle ranks of an institution and diffuse outwards. In doing so, we identify an underappreciated, social source of expertise acquisition by bureaucracies. Prominent work emphasizes top-down incentives for bureaucrats to obtain expertise (Gilligan and Krehbiel 1987; Gailmard and Patty 2007). This paper instead highlights the causal importance of horizontal mechanisms: interactions among bureaucrats of roughly equal rank support the spread of technical knowledge and can help institutions acquire the expertise needed to effectively address emergent policy challenges.

SOCIAL THEORY OF EXPERTISE

Expertise acquisition is costly for individual bureaucrats, particularly in technically demanding policy domains like climate (McCarty 2017; Perlman 2023; Singh, Thrall, and Zucker 2025). Developing expertise in any issue area requires the investment of effort. To the extent that bureaucrats are limited in the effort they can devote to any given issue area, effort to acquire climate expertise requires the sacrifice of attention to other policy domains and some erosion of performance on other professional tasks.⁴ The benefits of commanding expertise, however, can be substantial. Expertise improves policy design and implementation (Gailmard and Patty 2012), and may accordingly be rewarded by principals who control bureaucrats' career trajectories.

Some prominent work treats expertise as a natural product of extended government service; civil servants with longer tenures possess greater policymaking experience and deeper institutional knowledge, allowing them to outperform novice political appointees (Lewis 2007). Other influential theories focus on political principals' ability to manipulate the expected returns to expertise acquisition (Gilligan and Krehbiel 1987). For example, Gailmard and Patty (2007) theorize that policy-motivated bureaucrats will invest in expertise when principals commit to allow those bureaucrats to use their expertise to select good policies. While plausible, bureaucrats at a number of institutions likely receive mixed or inconsistent guidance from principals on the benefits of obtaining climate expertise. Recent

⁴This follows the canonical logic of mission creep, see Barnett and Finnemore (1999).

leaders of the IMF have been supportive of climate initiatives, for example, but the Fund's most powerful member states have historically been deeply divided on the issue (Clark and Zucker 2024). At domestic institutions, fluctuations in the climate preferences of elected principals may cast doubt on the long-term career benefits of investing in climate expertise.

Less work considers how bureaucrats learn from each other or how incentives to invest in expertise may vary according to interactions with colleagues. But there is initial reason to think that intra-staff relationships support the acquisition of expertise. Research has shown that socialization within political institutions, including active persuasion by and passive mimicry of colleagues, can lead to convergence in elites' political preferences (Johnston 2008). Heinzel, Weaver, and Jorgensen (2024) argue that women's representation at the World Bank can cause a "contagion effect" whereby men in the institution become more attuned to gender issues. Experimental work similarly documents how group settings powerfully shape how policymakers understand and navigate policy challenges, in part by providing information on colleagues' own preferences and by exerting social pressure to conform with those beliefs (Wayne et al. 2024). Work in educational psychology likewise finds substantial benefits to group-based "cooperative learning" (Slavin 2013).

We theorize that interactions between a bureaucrat and climate-attuned colleagues — those who see climate as of interest and relevance to the institution — increase the probability of that bureaucrat subsequently developing climate expertise. We propose three reasons for this. First, and most intuitively, interactions with climate-attuned colleagues reduce the effort needed to obtain information about climate change. This information may range from fairly basic — e.g., on whether climate is pertinent to an institution's mandate — to more complex, if bureaucrats exchange information about their experiences with specific policy instruments or provide guidance on policy analysis techniques. This is consistent with findings that the benefits of group-based learning flow from higher- to lower-information individuals (Webb 1989). Second, interactions with climate-attuned colleagues may enhance the perceived professional benefits of climate expertise. Bureaucrats are constrained in the total amount of effort that they can devote to their work. Investing in obtaining climate expertise thus requires a reallocation of effort from other tasks (e.g., analyses of other issues), which may pose some risk to bureaucrats' careers, particularly where managers espouse mixed or vacillating climate preferences. Interactions with climate-attuned colleagues may mitigate this risk. People often underestimate the extent to which others support climate action (Mildenberger and Tingley 2019). If working alongside colleagues reveals new information about their climate preferences, staff may subsequently update their beliefs about the distribution of climate attitudes within their institution. Particularly when such colleagues are senior to them, bureaucrats may accordingly become more confident that their institution supports and rewards climate expertise.

Updated beliefs about the extent of pro-climate attitudes in one's institution, and level of climate knowledge among colleagues, may also exacerbate the perceived risk of *not* holding some climate expertise. Expertise permits bureaucrats to select and implement good policies. In meritocratic institutions, where effective policy choice and implementation determine pay and promotion decisions, bureaucrats likely seek to avoid lagging behind colleagues in levels of policy knowledge.

Third, staff may be socialized into valuing climate expertise. Entrepreneurial bureaucrats may actively persuade colleagues as to the importance of climate to their institution's mission, leading staff to shift effort from other issue areas to climate. Subtler socialization dynamics may also emerge. Johnston (2008) documents attempts by individuals at international organizations to "fit in" with colleagues by changing their behavior. Johnston identifies patterns of mimicry, where an actor "sees others anticipating benefits [from some action] and assume that it too can hope to gain." While the motive here may be material, Johnston notes that mimicry is also appealing insofar as it helps individuals avoid being "viewed by others as out of fashion, behind the times, and thus missing out on a status-enhancing experience" (46). As interest in climate sweeps through organizations, staff accordingly may mimic — or actively emulate — the climate experts with whom they work. We thus hypothesize the following:

Hypothesis 1. Bureaucrats who work alongside climate-attuned colleagues should subsequently exhibit greater climate expertise.

DATA AND MEASUREMENT

We test this theory with original data on the career paths of individual IMF bureaucrats, interactions between bureaucrats, and the sophistication of IMF policy recommendations. Our source for these data are Article IV reports, which are the products of semi-annual surveillance missions undertaken by IMF staff teams to individual member states. These reports, which are authored by small groups of IMF staff, describe in detail the state of countries' economies, identify macroeconomic risks, and offer policy advice to host country governments. They exemplify the IMF's role as a source of economic policy expertise.

We collected data on 611 Article IV reports issued between 2004–2019, a period during which IMF attention to climate grew dramatically. Based on the listed authors of these reports, we identify 917 mid-level IMF personnel — resident representatives, mission chiefs, and rank-and-file mission team members⁵ — who contributed to multiple reports during these years. Using the reports that each staff member contributed to, we record the countries that each individual worked in, when they worked there, and, critically, the other personnel on the mission teams they were assigned to. Our data include 2,339 unique

⁵Resident representatives are IMF staff who are stationed in an assigned member state for a period of a couple of years at a time. Mission chiefs are typically drawn from IMF area departments (e.g., the Asia and Pacific Department) and lead the surveillance trips to member states, which typically last for less than a month. Rank-and-file staff are drawn from area departments and functional departments (e.g., the Monetary and Capital Markets Department). Mission teams generally include one resident representative, one mission chief, and 5–10 rank-and-file staff.

bureaucrat-mission observations.

Research team members manually extracted 8,496 unique policy recommendations from these reports. Using a dictionary of climate-related keywords (Appendix A), we identify 309 policy recommendations that explicitly relate to climate change or decarbonization, spread across 166 reports (27% of all sampled reports). We use these policy recommendations to estimate the climate expertise of contributing authors. To do so, we assume that the sophistication of the language used in the reports increases with bureaucrats' expertise. We measure sophistication by calculating the "lexical richness" of the text of each policy recommendation, a measure of "the number of different terms used in a text and the diversity of the vocabulary" (Torruella and Capsada 2013, 448).⁶ The sophistication of climate and non-climate recommendations follow similar normal distributions (Appendix B). In our analyses, we focus on maximum lexical complexity in order to capture the ceiling of a bureaucrat's ability to issue detailed, nuanced policy recommendations at any point in time; we interpret this ceiling as indicative of a bureaucrat's level of expertise.

Table 1 lists example recommendations at low, medium, and high levels of sophistication. As the examples suggest, low-sophistication recommendations are often brief and involve fairly non-specific advice. More sophisticated recommendations tend to be longer, exhibit deeper engagement with local conditions in a given country, and offer more specific and actionable policy advice. These characteristics, in our view, suggest a higher level of climate expertise among contributing authors.

We observe meaningful change in aggregate metrics of sophistication over time. Figure 1 indicates that climate-related recommendations were, at best, about 23% less complex than other recommendations in 2009. Over the next ten years, however, climate recommendations approached to the level of the most sophisticated non-climate recommendations. By

⁶We calculate lexical richness using Carroll's corrected type-token ratio, which is defined as $V/\sqrt{2N}$, where *V* is the number of "types" (unique words) present in a string and *N* is the number of words in that string.

Recommendation	z-score
Fiji's susceptibility to natural disasters and narrow export base suggest the need to continue building fiscal buffers to respond to adverse developments.	-2.6
Samoa needs to build fiscal resilience and buffers against natural disasters and achieve progress towards its development goals. At the same time, Samoa needs to ensure fiscal sustainability and use fiscal policy as the principal instrument of macroeconomic management in the face of external shocks, given the exchange rate peg and the weak monetary policy transmission mechanism. The needed ad- justment can be achieved by improving tax administration and controlling current spending.	+0.1
The Bahamas has traditionally absorbed frequent natural disaster shocks ex post through the public balance sheet. An increased reliance on ex ante mitigation poli- cies would help reduce and smooth the economic and fiscal impact of natural dis- asters. To this end, staff recommended integrating a well-designed natural disasters savings arrangement into the fiscal framework, insuring public assets through pri- vate natural disaster insurance and incentivizing the population to use these instru- ments more widely, including through targeted subsidies to improve affordability for low-income households - and making sure that building regulation, land use, and zoning guidelines are adequate and are reviewed and updated frequently.	+1.4
To create fiscal buffers, including to deal with future natural disasters, and to help ensure that public debt-to-GDP ratios remain on a clear downward path, staff rec- ommended eliminating the primary fiscal deficit after grants by 2022 through a combination of revenue-enhancing measures (i.e., eliminating VAT exemptions ex- cept for basic goods) and spending rationalization (i.e., review and reform of wage and hiring policies in the public sector). Tax administration reforms to boost rev- enue collection should continue, by improving the taxpayers' registry and elec- tronic information systems, enhancing tax compliance from large taxpayers with adequate risk analysis, and strengthening the extractive industry tax management. Meanwhile, the impact of these measures on the most vulnerable will be mitigated through increases in social spending assistance.	+1.9

Table 1: Sample of IMF policy recommendations, in ascending order by sophistication (*z*-scores of Carroll's corrected type-token ratios).

2019, the most complex climate recommendations were just 11% less sophisticated than other recommendations and 32% more sophisticated than they were a decade prior. We additionally observe evidence of individual bureaucrats becoming more sophisticated over time, consistent with prior work that treats expertise as a function of bureaucrats' length of service (Lewis 2007). For bureaucrats who coauthored climate-relevant policy recom-

mendations across multiple years, their first sets of recommendations are about 50% of a standard deviation less sophisticated than those authored in subsequent years.⁷



Figure 1: Maximum sophistication (lexical richness) of climate-related policy recommendations in Article IV reports by year, proportional to the maximum sophistication of non-climate recommendations in the same year.

ACQUISITION OF EXPERTISE

Here we test whether bureaucrats who interact with climate-attuned colleagues subsequently exhibit greater climate expertise. To do so, we estimate the following model by ordinary least squares:

sophistication_{*ict*} =
$$\beta \left[\mathbb{I}(\text{climate} = 1) \times \text{prior coworker attention}_{i(t-1)} \right] + \gamma \mathbf{Z}_{ict} + \delta_i + \zeta_t + \varepsilon_{ict}$$

This regresses the maximum sophistication of policy recommendations coauthored by bureaucrat i in a report for country c in year t on the climate relevance of that recommendation, interacted with the number of climate-attuned colleagues with whom the bureaucrat

 $^{{}^7\}hat{\beta} = 0.515 \ (p = 0.062)$. Ordinary least squares regression of climate-relevant recommendation sophistication (standardized) on a binary indicator of whether the recommendation was issued in the first year in which a bureaucrat discussed climate, or in any subsequent year. Controls for year of first mention and bureaucrat fixed effects; standard errors clustered by bureaucrat.

worked on *previous* missions.⁸ Controls include the count of climate disasters experienced in country *c* to account for contemporaneous drivers of climate attention (Clark and Zucker 2024), as well as the count of the number of years that a bureaucrat has been in the sample to account for any linear time trends. We additionally include bureaucrat, year, and report (country-year) fixed effects in the fully specified model.⁹ We cluster standard errors by bureaucrat. Our primary estimand of interest is β , the effect of prior coworker attentiveness to climate on the sophistication of climate-relevant recommendations, relative to non-climate recommendations.

	(1)	(2)	(3)	(4)
Climate-relevant \times coworkers	0.083***	0.086*** 0.086***		0.096***
	(0.017)	(0.018)	(0.018)	(0.024)
Climate-relevant recommendation	-1.154***	-1.025***	-1.025***	-1.003***
	(0.046)	(0.053)	(0.053)	(0.057)
Climate-attuned prior coworkers	0.015*	0.008	0.008	-0.010^{***}
	(0.007)	(0.014)	(0.014)	(0.003)
Ν	4616	4616	4616	4616
Control: climate disasters		\checkmark	\checkmark	
Control: years in sample		\checkmark	\checkmark	\checkmark
Fixed effect: year	\checkmark	\checkmark	\checkmark	\checkmark
Fixed effect: bureaucrat			\checkmark	\checkmark
Fixed effect: report				\checkmark

Dependent variable: Maximum sophistication (standardized)

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

Table 2: Regressions of the maximum sophistication of policy recommendations coauthored by a bureaucrat in a given year on the climate relevance of those recommendations (binary), interacted with the number of climate-attuned colleagues the bureaucrat previously worked with. Models estimated by OLS with standard errors clustered by bureaucrat.

Estimation results in Table 2 are consistent with our theory. Consistent with Figure 1,

⁸We define a climate-attuned colleague as one who issued at least one climate-focused policy recommendations prior to their mission with bureaucrat i.

⁹To measure climate disasters, we aggregate climatological and meteorological disasters recorded in the EM-DAT database.

we find that climate-relevant recommendations tend to be less sophisticated than other recommendations. This gap narrows significantly, however, for bureaucrats who previously worked alongside more climate-attuned staff. Results of model (3) indicate that a standard deviation increase in prior exposure to climate-attuned colleagues (+2) would be expected to increase the relative sophistication of climate recommendations by 17% of a standard deviation. This is a non-trivial change. For illustration, it is roughly the equivalent of moving from a recommendation that Mozambique institute "structural reforms together with better institutions to manage natural resource wealth and policies to build resilience to climate change" to a recommendation that "[Kiribati's] budget include an explicit provision for climate change adaption costs" in order to better implement the "Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management." We interpret the more specific and actionable nature of the recommendation to Kiribati as indicative of a higher level of bureaucratic expertise.

One methodological concern is that reports that discuss climate change may be systematically distinct from those that do not. This is plausible if climate recommendations primarily target more climate-vulnerable countries, which tend to be poorer and feature lower state capacity. If economic governance challenges tend to be more acute in more climate-vulnerable countries — or if climate-vulnerable countries rely more on the IMF for policy advice than other countries — Fund staff may construct more detailed policy recommendations for those countries across issue areas. The inclusion of report (country-year) fixed effects in model (4) helps account for this possibility. Estimation of this model indicates that within the same report, the sophistication gap between climate and non-climate recommendations significantly narrows when a contributing bureaucrat previously worked alongside more climate-attuned colleagues.

A second concern is that staff are not randomly assigned to mission teams. Managers who themselves are interested in climate may, for example, deliberately assemble teams of climate-attuned staff and encourage them to devote special attention to climate-related policy recommendations. This would confound the relationship between colleagues' climate attitudes and the contemporaneous sophistication of climate outputs. Here it is important to emphasize that our analyses focus on the effect of *prior* team assignments; in other words, how staff behave after being rotated off a given team. Hence we do not see selective exposure to climate-attuned staff as a major threat to inference.

These results collectively indicate that bureaucrats do meaningfully learn from colleagues within the institution. While incentives imposed by principals within the IMF may additionally spur expertise acquisition, we find that at any point in time, bureaucrats with more climate-attuned colleagues render meaningfully more sophisticated climate policy recommendations. The effects moreover appear to endure; years after interactions with climate-attuned colleagues, bureaucrats continue to exhibit higher levels of expertise.

Article IV mission teams feature personnel of multiple ranks. This allows us to evaluate whether bureaucrats learn differently from colleagues at different levels of the organizational hierarchy. In a series of secondary tests, we disaggregate prior colleagues by rank: whether they were a mission chief (highest authority on a mission team) or a more junior staffer. We further split the sample by a bureaucrat's own professional rank to test whether individuals learn from more senior or more junior colleagues.

Results reported in Table 3 indicate that staff are responsive to the climate attentiveness of colleagues of multiple ranks. However, staff appear to principally respond to equals or superiors; there is less evidence of bureaucrats learning from more junior colleagues. Model (2) indicates that staffers exhibit greater climate expertise after working alongside more climate-attuned colleagues of equal rank; one additional interaction increases the subsequent sophistication of climate recommendations by 12% of a standard deviation relative to non-climate recommendations. By contrast, there is weak evidence of more senior bureaucrats — mission chiefs or resident representatives — acquiring expertise following

	(1)	(2)	(3)	(4)	(5)
Sample:	All	Staffers	Non-Staffers	All	Staffers
Climate-relevant \times staffers	0.104***	0.124**	0.059		
	(0.032)	(0.045)	(0.113)		
Climate-relevant \times mission chiefs				0.313***	0.374***
				(0.064)	(0.065)
Ν	4616	3904	715	4616	3904
Control: years in sample	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Fixed effect: year	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Fixed effect: bureaucrat	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Fixed effect: report	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark

Dependent variable: Maximum sophistication (standardized)

+ p <0.1, * p <0.05, ** p <0.01, *** p <0.001

Table 3: Regressions of the maximum sophistication of policy recommendations coauthored by a bureaucrat in a given year on the climate relevance of those recommendations (binary), interacted with the number of climate-attuned colleagues the bureaucrat previously worked with (disaggregated by professional rank). Models estimated by OLS with standard errors clustered by bureaucrat. "Non-Staffers" in model (3) are mission chiefs or resident representatives.

interactions with junior staffers (model 3).

Notably, staffers appear to be dramatically more responsive to mission chiefs with whom they work. Model (5) indicates that one prior assignment to a team headed by a climate-attuned mission chief increases the relative sophistication of a bureaucrat's sub-sequent climate recommendations by 37% of a standard deviation. This point estimate is more than three times that found for learning from staffers of equal rank, suggesting that more senior bureaucrats powerfully shape the ideas and incentives of junior colleagues. On small mission teams, senior bureaucrats may influence the transfer of information between colleagues; staffers may be more likely to discuss climate amongst themselves, for example, when it is of interest to their team lead. The climate attitudes of team leaders plausibly also affect the material incentives of junior staff. Working under a climate-attuned mission chief may lead junior staff to see greater career benefits to investing in climate expertise,

insofar as the mission chief has some sway over the staffer's professional advancement within the institution.

CONCLUSION

How do institutions develop expertise in novel, complex policy domains? Influential accounts hold that bureaucracies acquire expertise when incentivized to do so by political principals, such as via the delegation of policy discretion to civil servants or implementation of meritocratic recruitment rules (Gailmard and Patty 2007; Dahlström, Lapuente, and Teorell 2012). Here we propose an alternative, and perhaps complementary, way by which bureaucracies can obtain expertise: interactions among individual bureaucrats. Such interactions facilitate the spread of policy knowledge, modify the perceived professional returns to investing in expertise, and exert subtle socialization pressures that encourage bureaucrats to learn about an emergent issue.

We develop and test this theory in reference to climate change, an issue increasingly embraced by institutions lacking in climate expertise. Focusing empirically on the IMF, we introduce original data on interactions between individual staff members and those bureaucrats' climate expertise. We document, first, significant growth in average levels of climate expertise within the IMF over the last two decades. In the late 2000s, when interest in climate at the IMF first emerged, climate-related policy recommendations issued by Fund staff were far less sophisticated than the recommendations made in other issue areas. By the late 2010s, climate recommendations had begun to approach other recommendations in their complexity and detail. In a series of statistical tests, we find that interactions between staff support this apparent growth in expertise: bureaucrats who work alongside climateattuned colleagues go on, on average, to develop significantly more sophisticated policy recommendations than bureaucrats lacking such interpersonal contacts.

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APPENDICES

- A. Climate KeywordsB. Distribution of Sophistication

A. CLIMATE KEYWORDS

We use keyword searches to identify climate-related policy recommendations. Recommendations are coded as climate-relevant if they include at least one of the following terms:

- "adaptation"
- "bali action plan"
- "bali roadmap"
- "cap and trade"
- "carbon"
- "clean development mechanism"
- "climate change"
- "climatenchange"
- "climate changen"
- "climate finance"
- "climate politics"
- "conference of the parties"
- "disaster risk"
- "disaster hazard"
- "emissions trading scheme"
- "framework convention on climate change"
- "ghg"
- "global average temperature"
- "global environmental facility"
- "global warming"
- "green climate fund"
- "greenhouse effect"
- "greenhouse gas"
- "greenhousengas"
- "environmental politic"
- "environmentalnpolitic"
- "intergovernmental panel on climate change"
- "ipcc"
- "kyoto protocol"
- "mitigation"
- "nationally determined contribution"
- "natural disasters"
- "paris accord"
- "paris agreement"
- "renewables"
- "renewable energy"
- "renewablenenergy"
- "unfccc"

B. DISTRIBUTION OF SOPHISTICATION



Figure B1: Distribution of the sophistication of policy recommendations.