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**CODE ENCOUNTERS REPORT 1:**

# **Housing and Algorithmic Risk Profiling in England: Report of overarching findings**

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# Preamble

This is the first report in a four-part series that explores the development, operation, and impact of digital risk profiling tools in England's mortgage and rental markets. This report - *Code Encounters Report 1: Housing and Algorithmic Risk Profiling in England - Report of Overarching Findings* - offers a series of digestible overarching findings from across the tenures along with key recommendations.

The details of all four reports are as follows:

- *Code Encounters Report 1: Housing and algorithmic risk profiling in England - Report of overarching findings* (2024) by Alison Wallace, David Beer, Roger Burrows, Alexandra Ciocănel and James Cussens. Centre for Housing Policy: University of York.
- *Code Encounters Report 2: Digital tenant risk profiling in England's private rented sector* (2024) By Alison Wallace, David Beer, Roger Burrows, Alexandra Ciocănel and James Cussens. Centre for Housing Policy: University of York.
- *Code Encounters Report 3: Data and automation in pre-tenancy affordability checks in social housing* by Alison Wallace, David Beer, Roger Burrows, Alexandra Ciocănel and James Cussens. Centre for Housing Policy: University of York.
- *Code Encounters Report 4: Credit risk decisions, mortgage lending and technological possibilities* (2024) By Alison Wallace, Alexandra Ciocănel, David Beer, Roger Burrows and James Cussens. Centre for Housing Policy: University of York.

The reports are based on a study aimed at:

- Understanding tool production: The study examines how credit rating agencies (CRAs), lenders and data analytics firms build credit scoring and tenant screening tools. It investigates the data used, how representative it is, the criteria for creating risk profiles, and how this information is communicated to key stakeholders.
- Exploring deployment motivations: The report assesses why housing professionals adopt these tools, focusing on policy, market, and regulatory influences and the risks they aim to manage across different sectors.
- Examining practical deployment: The study looks at how these tools are integrated into everyday housing practices, how they affect professional judgement, and how compliance with regulations like data protection and consumer standards is maintained.
- Investigating perceptions and awareness: It explores how well professionals and consumers understand these tools, their awareness of the data involved, and the impact on housing access.
- Assessing market impact: The study considers how professionals and consumers respond to the use of these tools, including potential exclusion or gaming of the system, and the balance between privacy and efficiency.

- Considering policy implications: It reflects on the regulatory and ethical issues raised by these tools and their broader role in shaping housing markets.

All four reports along with a literature review, briefings and a series of articles published in peer-reviewed journals are available to download from the project webpages <https://www.york.ac.uk/chp/housing-markets/code-encounters/>.



# Chapter 1: Introduction

The ongoing and varied implementations of algorithmic systems, machine learning and other forms of artificial intelligence are continuing to change how risk is assessed, how decisions are made and how people are judged. As such, the algorithmic processing of assessments of risk and access have profound implications for equality and opportunity. These types of automation are already having wide-ranging implications for individual life chances and for the make-up of the communities and places in which we live. This is particularly the case where algorithms are involved in automating the assessment of risk with regard to decisions over lending and over who has access to what housing. There is the potential for inequalities to be coded into the very decision-making systems and processes that directly impact people's lives. To understand this impact it is crucial to understand how and where these algorithms fit into organisational processes and how they become integrated into the practices of those involved in their implementation. Considering the hidden processes that influence access to housing is important, especially as we are at a critical point when finding an affordable, secure and decent home represents a significant challenge for many.

The Code Encounters project (2022-2024) examined the construction, operation and impacts of algorithmic risk-profiling tools that mitigate lenders' and landlords' risks in providing access to housing. It was concerned with exactly how algorithms are being implemented in practice and with what implications these might have, with a focus on private rented sector digital tenant referencing products, affordability assessments and pre-tenancy checks in social housing allocation processes, and credit risk decision making in mortgage lending. The project has produced a series of insights into how algorithms mediate access to private and social rented homes and mortgages. This was the first UK study to examine the housing access applications of these information-based and automated risk-profiling tools. The project saw the construction of an extensive and detailed qualitative dataset, incorporating 122 interviews with participants from across the sector, including those impacted by the use of algorithms alongside a range of stakeholders and decision-makers involved directly in digital risk profiling and access to housing.

By looking at the integration of algorithmic systems within decision-making across the three housing tenures - private renting, social housing, and mortgage lending for homeownership - and deploying a specific focus on the societal impact of risk-profiling tools and other technologies, the Code Encounters project has been able to provide insights that overcome the powerful images and narratives attached to the technologies and platforms associated with housing and proptech. These visions, we have found, can create potential misconceptions concerning the extent to which algorithms are involved in assessment and decision-making. The project findings redress these potential misconceptions and provide a robust account that can be used to inform interventions, policy recommendations and impact activities, as well as feeding into wider public debate on the topic. The project findings also have wider ramifications for the different sectors and service industries that are turning to algorithmic and automated decision-making processes. This project has focused on risk profiling and access in housing, whilst its findings will also have relevance in any sector or organisation where algorithms are being integrated.

This short and digestible report (Report 1) is intended to provide an overview of the project's overarching findings and recommendations, whilst the other three accompanying reports provide further and specific detail and insight into the integration of algorithms through close examinations of the different tenures: private renting (Report 2); social housing (Report 3); and

credit risk decision making (Report 4). Below we identify and concisely outline twelve key overarching findings. We then offer specific conclusions and recommendations based upon those overarching findings and the tenure-specific reports. We close with ongoing questions identified through our research. For ease of access and as supporting information, this report also contains two appendices: the first contains a brief summary of the three tenure specific reports (Appendix 1) and the second is a note outlining the methods used on the project (Appendix 2).

## Chapter 2: The Code Encounters project's overarching findings

### Finding 1: A time of significant and rapid transition

We have found that a key defining feature of the participants' accounts is that they are experiencing a particularly significant period of open-ended transition. The current moment is dominated by technological change that is underway and continuing. This period of transition is provoking a strong sense of uncertainty about how to handle the altering algorithmic opportunities, and about the exact direction these changes will continue to take. With advancing algorithms, this is a moment of ongoing and rapid change in risk assessment and access to housing decisions. This change has been underway for some time and is yet to be completed, indeed it may be a long-term state of change as new powerful technologies like generative AI become mainstream. Participants report being sure that more change is to come. They expect ongoing transition in terms of the expanding use of data and the increasing implementation of automation, algorithms and other AI systems in decisions concerning risk profiling and access to housing.

Transformations in systems and processes have created questions for our participants about how best to proceed and what form the future might take. Across the housing system stakeholders are unsure about how automation will develop further or what aspects of existing processes should become algorithmic, and which shouldn't. Similarly, there are allied questions raised over which types of data should be drawn upon. Different approaches have been taken and algorithms are now established in various forms, especially in referencing and rating. Yet there is no fixed set of approaches. The transition and uncertainty being experienced directly impact how algorithms are approached and implemented.

The limits of algorithmic processing are unknown and there are few precedents or established processes on which to draw. Crucially, those engaging with these systems are making active and contingent decisions about where to deploy algorithms and how to fit them within processes. These applications of algorithms are being reinvented in different ways across the sector as a result. The organisations and individuals within them are trying to work out how best to draw upon such systems and where the limits of this integration ought to be located.

As this is a moment of transition, with new developments and shifting decision-making processes, the future direction is yet to solidify into place. As a result, this period of transition makes this an important moment and opportunity for policy, guidance and other interventions that can shape that future.

### Finding 2: The variegated landscape of automation

We have uncovered a highly variegated landscape of automation within the housing sector. The transitions and uncertainties, along with the vast range of products, services and platforms that are available, have resulted in this variegation. Algorithms aren't being applied evenly or at the same pace. The close-up analysis of the practices of our participants has revealed the differences within and across the sector and tenures. These differences are significant and substantial, with highly varied levels of algorithmic processing being deployed in different areas



and with different techniques applied, especially within private rental. The pace of change also varies, which will lead to greater levels of variation in the future.

As mentioned, the variations occur within and across the housing tenures. For instance, despite being an early adopter of digital processing and credit scoring, from our study mortgage lending was now less algorithmic than much private renting in its adoption of automated processes and new digital data resources. Interviews suggested that the legacy of previous waves of automation and ageing technology now acts as a barrier to the uptake of newer systems. Open Banking and automating administration are being considered but challenges remain. Private renting tenant risk profiling sees smaller companies populate this space drawing in greater digital data and Open Banking analytics. Social housing is the least algorithmic, retaining many analogue systems and processes but, like the other housing tenure, increasingly interested in data analytics and automation of administration to enhance business insights and create efficiencies. The imperative towards the increased use of digital data in automated systems remains apparent even if at different stages.

As this suggests, the interviews made clear that there now exists wide-ranging adaptations of algorithms within the profiling of risk and in judgments around access to housing. These vary in the depth of applications, in the forms that they take and where and when the algorithmic interventions occur. Parts of this sector are also integrating algorithms at different rates to others - meaning that the variegation in approach is likely to escalate over the coming years. There are also different visions about which aspects of the decisions around access should be made algorithmic now or in the future. Questions about ethics and fairness are being considered alongside the technical possibilities and availability of data and algorithmic products. These questions are also impacting on the varied rate of applications. We found that currently there are parts of the processing of decisions deemed acceptable to make algorithmic, such as aiding with the completion of forms or in producing reports, whereas there are others that are deemed not acceptable for algorithmic processing, such as the checking of decisions and the confirmation of outcomes which was generally reserved for human action.

### **Finding 3: The burgeoning industry of analytics (and the platforming of risk profiling)**

With the expansions of data sources and the potential of algorithmic processing to increase efficiencies, a growing market for providing risk profiling solutions now exists. There is an increase in those providing platforms and services aimed at various parts of the housing system. An array of products exists and there is a burgeoning industry of analytics and algorithmic platform providers within housing. By providing so many options, the variety of available platforms, products and services is contributing to the further variegation in the sector (see Finding 2). This variety of products and services are being implemented differentially. It also means it is unclear which type of product and service will become most influential in the future. The burgeoning analytics industry is yet to stabilise and leading products are yet to be fully established.

A further consequence is that as the market expands the marketing and promotion of products will shape the actual presence of the algorithmic technologies and their reception. Disaggregating the possibilities and promises associated with these systems and services from their actual implementation or intended future implementations is not straightforward. These visions feed into understandings of the future of the sector. Our research indicates that the

take-up is varied and stakeholders in housing are often highly reflective on the limits, utility and potentials of those platforms, products and services.

## **Finding 4: Retaining human input in circumscribed roles**

A common notion when approaching algorithms and AI is to think of where the human is retained within the loop. This type of idea permeates into the participant's accounts of algorithmic systems in the Code Encounters project. Where algorithms are incorporated they are often accompanied by human action. This is something that participants had often reflected on prior to the interviews and they were often able to articulate a distinction between human and algorithm aspects of their processes. The retained presence of human actors in their accounts is often circumscribed and actively considered - turning to phrases like 'manual' as a way of demarcating human input into systems.

There is no evidence at this stage of fully automated processing in tenant or mortgage borrower risk profiling. There was also very little evidence of a desire for decisions to be handed over *entirely* to an automated or algorithmic process. This means that rather than full automation there are now various mixed versions of hybrid systems in place, in which humans are informed by or decisions shaped by algorithms (the specifics of these hybrid systems in the different tenures are covered in Reports 2, 3 and 4). This was particularly pertinent in ensuring fair access to housing. Human intervention was important to smooth access, albeit sometimes on less favourable conditional terms, to rented properties or mortgages, when people's circumstances did not fit neatly into the fixed models (discussed further in Finding 6 below). The way that the human and algorithmic relations are managed is part of the contingent decision-making occurring within the sector. There is a varied blend of human and algorithmic processing occurring that has implications for how decisions are reached, even if they are not yet fully produced by algorithms. A careful analysis of the role of the algorithm shows that they are frequently restricted to particular tasks, such as processing and inputting, and often the human is maintained to check or oversee algorithmic processing. Here we find consideration of not just the retaining of the human in the loop, but also the division of labour between the human and the algorithm. This has implications for how oversight is implemented and the extent to which checking is maintained over time and as algorithmic processing becomes more complex or less transparent to those working with it.

## **Finding 5: A heightened sense of risk**

The lack of familiarity with vast new data sources and the complexities of algorithmic systems, combined with the opaque nature of the processing done by algorithms, means that those with responsibility for decision-making can experience a heightened sense of risk when algorithms are integrated into their processes. Algorithms bring concerns about exactly how decisions have been reached or that errors or missed opportunities might occur. Due to this, algorithms can create a heightened sense of risk amongst those implementing or applying them - which then impacts on the willingness to implement algorithms. The same can be said for the utilisation of new forms of data, which bring concerns about usefulness and accuracy. This sometimes takes the form of a type of automation hesitancy.

There exist confidence deficits. Participants communicated being unsure and, allied with this, to also being concerned or worried about how to handle the changes underway without creating or exposing themselves to harm. Senses of risk are a key factor where algorithms are used to

inform or make decisions. Some of the lines of responsibility are unclear which is also part of where and why risk is felt. The sense of risk plays a key part in whether algorithms are incorporated and at what speed or level they are integrated into decisions. There is a hesitancy to take up systems caused by this sense of risk. Again this hesitancy means that the integration of algorithms is not continuous and nor is the direction or increase in the use of algorithms assured. Participants were exploring the potential as well as the limits of new data and automation. Consequently, there are different levels of hesitancy associated with varied senses of risk, which is often associated with the type of role that a participant has and the responsibilities attached to that role.

## **Finding 6: Managing the inflexibility of algorithms**

A common conception of algorithmic processing is that it is inflexible and that it lacks the adaptability of human decision-making. This perceived inflexibility impacts on how algorithms are utilised. The algorithm's perceived inflexibility means it is thought to potentially miss key details, which it is unable to notice or respond to, or that it creates outcomes that are too rigid and fixed. This can have implications for those seeking a home, where inflexibility might increase inequalities, especially where inflexibility prevents adaptability to individual circumstances. For example, in private renting, we noted that those with non-standard employment, thin credit files or people who differed from the young professional 'ideal tenant', struggled to be accommodated within the risk profiling models. There are also other thresholds impacting access to a tenancy, such as differences in geography, neighbourhood, property, landlords' individual risk appetite and external environmental changes.

We have highlighted how the sense of risk appears to be high where new algorithmic processes are applied, this can be associated with this inflexibility of algorithms and the risk of the decision being wrong or not being able to be remade or reshaped to suit the conditions or subjective inputs. Taking the human out of decisions regarding access to housing in particular brings with it worries over what might be missed and the consequences of the lack of flexibility that the integration of algorithms might bring. This is not to suggest that humans make such decisions without bias or prejudice, but that algorithms bring with them potentially different encoded models, modes of judgement and potential forms of discrimination. There is also the veneer of objectivity that data and algorithms can project despite them codifying human judgments, including on things such as types of expenditure. Yet those involved often seek to include human oversight and checking. This is to integrate flexibility into the system and to avoid mistakes or errors, but it is also to overcome where algorithms are thought to be rigid or where they might miss key bits of contextual information about the people being profiled or assessed.

## **Finding 7: Resisting powerful techno-visions of the present**

This picture of variegation and hesitancy contrasts with some of the visions that accompany the technologies and platforms, which are often presented in terms of the rapid and wholesale move of decisions to algorithms. These visions are based on the powerful capabilities of these systems. Present visions are of a very rapidly changing sector in which algorithms and platform technologies are quickly becoming the industry standard and where decision-making is becoming automated rapidly and without question. The impression is of imminent and full automation. We found something quite different to this vision from the participants across the tenures.

There is much more caution in making aspects of decision-making algorithmic. The approach taken by participants frequently resists the push for rapid and total adoption of these systems. This is not necessarily a form of resistance to algorithms, but just that a more measured and questioning perspective is often taken - where participants report on balancing concerns with possibilities. The vision of the technology is not necessarily fully accepted by those implementing the systems. In the practices of those involved in decisions around access to housing, there is a great deal more reflection about the use of algorithms now and also where this will head in the future.

## **Finding 8: A defence of expertise and judgement**

The automation brought about by algorithms can provoke a defence of the role of expertise and judgement. Professionals involved in decision-making have established knowledge upon which they call to make decisions over rental, lending and housing access. By-passing human intervention algorithms can also create a challenge to expert knowledge and insight. In some cases, this is seen to undermine expert judgement and therefore can provoke a defensive response or place constraints where algorithms are applied so as not to undermine this expert judgement. We found this amongst those who seek to use established and accumulated knowledge to inform decision-making processes. For example, where debt advice workers resisted and considered unnecessary the automation of income maximisation software or lenders placed value on people identifying fraud that computers could not fully interpret.

There is an attempt to protect the expert judgement when threatened by expanded automation of tasks. There is also a sense that there are those who have developed a feel for the right tenant and an ability to look beyond data to understand individuals and individual cases. This sensitivity toward judgement and knowledge is protected in some cases or is actively being retained. The implementation of algorithms can create tensions in expertise and can also be seen to create problems that expert knowledge and judgement can avoid. Expertise is seen to bring with it an ability to identify the right decision, and to also be able to identify anomalies, errors or potential misreadings of the data. Valuing professional expertise informed participants decisions about deploying algorithms and new data. Any integration of algorithms needs to respond to this context and would be applied in ways that maintain aspects of expert judgement - or, alternatively, that show how expert judgement can be enhanced or complemented by algorithmic automation.

## **Finding 9: The potential opacity of algorithmic decisions**

A key problem we found is that viewed from the outside it can be very difficult to identify where a decision is in some way a product of algorithms. This has implications for tenants and landlords in particular. There is an opacity over the use of algorithms which can be exacerbated by commercial interests in presenting the organisation as being algorithmic. The presentation of systems and services can give impressions of the extent of the use of algorithms without the specifics being clear. A tenant or landlord, for instance, may then be unclear on the type of data used or the role of the algorithms in reaching outcomes. The implementation of algorithmic processing of data is producing unknowns for those involved, including tenants and landlords.

It is not always easy to tell from the outside if algorithms are involved in decision-making. There are different agendas and motivations behind the public presentation of organisational processes and services. These agendas can make it hard to tell where algorithms are present

and to what extent. Sometimes services and their outputs can appear automated when, in fact, human actors are involved. In other instances, algorithms might be making decisions using data in the background in ways that those involved (both making decisions and those who are impacted by those judgments) will not be able to see. In some instances, processes are less algorithmic than they appear. In other cases, the use of algorithms might appear to be overstated when in fact humans are responsible.

From a tenant perspective (and sometimes from a landlord perspective also), it is possible that it is currently unclear how a decision has been arrived at and what level of data-informed algorithmic processing has been involved in that decision or outcome. There is a need to ensure that there is transparency about the level and role of algorithms within decisions around housing access. Given the change and variation we have described across the four reports of the Code Encounters project, it is necessary to ensure that tenants and borrowers are clear on how decisions about them have been reached. This is especially the case when we consider the highly varied levels and uses of algorithms we have identified in this project. Knowing how decisions are reached is critical for equality duties and data protection compliance, for tenants knowing how to claim their rights, as well as managing their digital profiles to secure future opportunities. Tenants have a general sense of the use of algorithms, but it does not seem clear to them the extent or exact application of algorithms in the decisions that impact upon them. This creates issues of trust and uncertainty about the outcome and the level of intrusiveness of the data gathering behind the decision. On this, it is important also to consider potential trust issues in these systems expressed by landlords facing change or who are unsure how tenants are selected.

## **Finding 10: More algorithms in the future**

Despite the varied levels of application of algorithms, the sense of risk and the defence of human expertise identified, there are established visions of a future in which algorithms will play a greater role in risk assessment and access in the housing sector. Even where concerns are expressed there is often a sense that this future expansion of data-informed algorithmic processing is inevitable. The vision is not of full automation, but of an ongoing and inevitable expansion of the role of algorithmic processing. Building on our point about ongoing transition, it is also clear that there will be an escalation in the use of algorithms and other forms of artificial intelligence and machine learning across the tenures of the housing sector into the future. For example, there are moves to use generative AI to draw data and documents together instantly for private sector lettings or for machine learning to identify additional variables from Open Banking that pose default risks that could also be applied to mortgage lending and rental risk profiling.

While there was often a disjuncture between the visions of technological firms and more sober assessments of those operating or expected to operate new digital systems, typically all had an interest and desire to continue to increase and expand the involvement of algorithms. Notably the adoption of new technologies was pursued or at least explored by promises of administrative efficiencies, increased accuracy in risk decisions and cost savings. What is clear is the presence of an expectation that there will be increases in the range and density of algorithmic processing within decision-making and risk profiling in the future. In some cases, the level of automation is expected to rise to very advanced levels. In other cases, key aspects of the processing of decisions and risk profiling have been identified and demarcated where algorithms are expected to come to make more advanced interventions in the future. In others still, there are spaces identified where human intervention is expected to remain even if



algorithms extend further. The expectation is that existing barriers and confidence deficits will be overcome. The future is very likely to be more algorithmic, in terms of risk assessment and housing access, because that is the direction these stakeholders are anticipating. The move will be towards greater levels of algorithmic input, even if there is very little anticipation of full automation in the housing tenures.

## **Finding 11: The establishment of difficult new questions for stakeholders**

With the integration of algorithms those operating within private rental and social housing, as well as across tenant referencing and lending, are now being forced to ask new questions about their values and practices. Automation has altered the relations within the sector and has also created questions about where and when to use algorithms. It also creates new questions about fairness and the ethics of the data and algorithms being implemented. Algorithms are bringing challenges for status and expertise, they also pose questions about responsibility, efficiency and discretion. These difficult new questions for stakeholders are being tackled within the everyday practices of those involved. As we have already discussed, algorithmic processing can undermine expert knowledge and judgement by seemingly substituting subjective human perceptions for objective algorithmic efficiencies. This has an impact on those exercising judgments of risk and access. Across the housing system, landlords and lenders maintained oversight to override digital recommendations when considered appropriate.

The increasing integration of algorithms means that those involved in housing access decisions are facing a range of new questions, many of which are ongoing. Those working in the sector are trying to find new techniques, strategies and terminology to make sense of and demarcate the altering presence of algorithms within their decision-making processes. Along with risks, data privacy, expertise and judgement being challenged, there are also questions posed about what is the right, just or effective way to change practices to suit the new possibilities. In social housing for example, some landlord participants considered the sensitivity of some questions relating to allocations inappropriate for algorithmic processing, where other landlords add workarounds to add online guidance and support to tenants impacted. There are also questions about how efficiencies might be provided, through automating processes to save staff time or through identifying risk that increases tenancy sustainment, for example, and how processes might accelerate as a result. Questions around data accessibility, the costs of efficiency, the oversight of the rigidity of judgments of algorithms and the flexibility of considerations of individual circumstances have all become urgent questions. So have questions around equality and fairness in judgments.

There is uncertainty about how algorithms will impact regulatory responsibilities in terms of equalities legislation and data protection compliance, and how such responsibilities will be navigated into the future. The delineation of responsibility is one area in which these new questions are emerging. In short, new questions have arisen about processes where previously relative stability and certainty had been established.

## **Finding 12: Ensuring future data availability**

Data availability is necessary for algorithmic processing to occur. Increasing data availability creates greater scope for algorithmic processing. Despite the varied levels of algorithm use in



the sector, there are now established means by which data availability is also expanded to underpin this. It is clearly an aim to increase the availability, range and depth of data. There is also a pursuit of more stable, online and even real-time forms of data, such as Open Banking data. These are seen as a fundamental part of the foundations of expanded automation of analytics and risk profiling.

Despite the variegation described in this report, there appear to be some key technical developments with regard to ensuring data availability that are becoming established and that will have a significant impact in the future. Despite the varied approach to automation the key developments ensuring data availability are becoming more widely used. Most important among these are Open Banking and tenant passporting. They are also seeking reliable and comparable data to feed into algorithmic processing. Developments like Open Banking facilitate this by enabling access to banking transaction data.

It was acknowledged that more data is available to be deployed in risk profiling than ever before, from financial to behavioural data, and that this volume of data is increasing. Open Banking data was becoming important across the housing system. This may support access for people with thin credit files and as the technology matures holds the promise of more accurate affordability assessments benefitting some and undermining others. Open Banking comprises another way for financial services and landlords to gain insights about people, but also provides an arena for moral judgements to be made about spending patterns. As lenders and landlords make inferences about financial behaviours from these data, tenants and borrowers will need to consciously manage their transaction data, much like public awareness of the necessity to manage credit scores has grown. The advent of tenant passports in private rental markets could make this exercise critical, as they would possibly favour the 'ideal tenants'. Managing our digital capital will increase in importance.

## Chapter 3: Conclusions and recommendations

Together this set of overarching findings provides a picture of a transition in which those involved are actively trying to manage the changes and shifts that are underway. More change is expected in the future. Algorithmic systems have already been implemented within risk profiling and access to housing (described in more specific detail across the different housing tenures in Reports 2, 3 and 4). This project has made clear that despite the sense of risk and the hesitations over the integration of algorithms, the future will see greater levels and escalations in data extraction and automation of risk profiling and analytics. There is a strong sense of the inevitability that algorithmic and artificial intelligence will take on an even greater presence in the future, across the tenures we have studied.

As this is a period of transition, steps need to be taken to ensure that these changes can be understood and are both transparent and consistent. The uncertainty about the appropriate use of algorithms and data, combined with the opacity for those subject to judgments, means action is required to ensure opportunity and fairness and to prevent inequalities from being automated, untraceable and hard to challenge. Algorithms needs to be applied in ways that ensure, rather than potentially undermine, equality, opportunity and access. There is uncertainty at the moment about how best to implement algorithms and also uncertainty about how algorithms should be expanded within decision-making and risk assessment processes. Our recommendations are based on tackling this moment of transition and addressing the uncertainty, as well as protecting those who are impacted by automated risk profiling or housing access decisions made through algorithmic processing. Managing the ongoing transition will be vitally important in ensuring equality, opportunity and social mobility into the future.

Our recommendations are aimed at firms creating algorithmic risk profiling tools; landlords, agents and lenders operating them; government departments and regulators overseeing fair access to housing, financial services and data management; trade bodies supporting and providing advice to their landlord and lender members; and bodies responsible for public financial education.

### Recommendation 1: Making visible how data and algorithms have been used in each decision

Our first recommendation is that it should be completely clear to all stakeholders, including landlords and tenants, exactly where algorithms have been applied in the decisions taken and, also, the data sources that have fed into that algorithm in order for it to arrive at an outcome. Both the data sources that feed into the algorithmic recipes and the role of algorithms within the processing of applications and decisions should be visible and clearly presented through a sector-wide step-by-step guide that is produced by those assessing risk or making access decisions. It should be made available to all parties, including tenants and landlords.

To ensure the guide is simple and comprehensible to all parties we would suggest a recipe format is adopted, as this is a familiar format whilst also fitting with the design of algorithmic processing - an alternative would be a decision tree format. A template for the 'Recipe for how data and algorithms were involved in our decision' should be made available. That template can be completed to show where, and with what data, algorithms have been involved in decisions.

If applied, this recommendation would provide greater transparency in the way data is gathered from and about tenants and borrowers and clarity about how these data have been used in risk profiling and access decisions. Current privacy statements are inadequate and key facts about the data collection, purpose and processing and how it informs critical decision-making should be unavoidable when clicking through platforms.

The responsibility for understanding the role of the algorithm and the source and type of data from which it operates should be with those taking the decision regarding risk and access. The process should be visible to all involved or affected. This will help to create greater certainty across the housing system - removing uncertainty for all stakeholders and rendering decisions transparent, trusted or open to question.

## **Recommendation 2: To establish agreed guidelines on the appropriate use of algorithms for stakeholders within the sector and tenures**

We would recommend sector-wide guidance across the tenures regarding the most effective and appropriate ways to implement algorithms. The suggested aspects of risk profiling and access decisions that algorithms might assist with can then be delineated, removing the need for contingent decisions as stakeholders encounter new algorithmic products and services.

To ensure this remains up-to-date it should be regularly reviewed and updated. This guidance would articulate the limits of algorithms and the circumscriptions of the roles of algorithms. Such guidance will help to alleviate uncertainty about how to implement algorithms and will help to ensure a greater level of consistency across the sector.

## **Recommendation 3: Guidance on the use of data and algorithms for tenants and borrowers**

As well as understanding their individual decisions, there is a wider need to increase public awareness of the use of data and algorithms in risk profiling and access to housing. We would recommend a guide for tenants on their rights and options concerning the use of data and algorithms in the decisions impacting their access to housing. This would also be a useful source for landlords in managing their selection and ongoing relations with tenants.

The availability of such a guide will ensure that informed choices can be made. This would allow questions to be raised where these are contravened. Such a guide would ensure that individuals are able to understand their own situations more clearly and can then adapt and respond to those conditions to ensure their equal and fair treatment. It also allows potential tenants and borrowers to plan ahead before they apply, managing their data profiles and standing, much as people now manage their credit scores, and to then seek and receive equality of opportunity when proceeding.

## **Recommendation 4: The retention of human oversight**

It should always be the case that human input is retained to check and oversee any decisions that are informed by algorithms. No decision concerning risk profiling and housing access should ever be made entirely by unsupervised algorithmic systems. A record should always be

made that makes clear human intervention in these processes. This should be a requirement in all decisions regarding housing access.

It is crucial that human oversight is maintained so that decisions can be checked for fairness, can be articulated clearly, and so that clear responsibility for the decision is taken and that outputs can be altered or overridden before final decisions are made, should it be necessary to do so. This will also enable participants to override decisions that are clearly inappropriate, inequitable or biased. It also maintains expertise and expert judgement, avoiding potential deficits of knowledge concerning risk and access in the future, preventing expertise from being reduced by over-reliance on algorithms. The retention of human oversight should be set as a requirement across the three tenures.

## **Recommendation 5: Ensuring the explainability of decisions**

All decisions and outcomes should be explainable in terms of the process that has been followed and the way that the decision has been taken. The grounds upon which the decision itself was made should be something that can be fully explained so that the logic and reasoning are clear, not least for public agencies where decisions may be subject to legal challenge. The above recommendation (Recommendation 1) concerning the clear record of how decisions are reached will assist in ensuring explainability.

Organisations must be able to fully articulate how a decision was reached, including the data used, where algorithms were involved and the human oversight of the outcome. The exact action of the algorithm itself should be transparent in this explanation. This explainability of the outcome provides further opportunity for decisions to be understood, so that equality can be ensured and so that decisions are not hidden within a 'black box' or behind a lack of clarity over data and algorithms. Crucially, the presence of expanded and more complex automated systems should not be used as an opportunity to conceal processes and reasoning.

## **Recommendation 6: Ensuring the retention of flexibility and individually tailored decision-making**

Finally, we would suggest having a system in place in which the inputs into algorithmic processing can also be adapted to enable flexibility and to ensure that both input and outcomes remain flexible and adaptable to the individual being assessed. Decisions should be made on an individual basis and informed by individual circumstances. Problems with the implicit bias of algorithms should be prevented from emerging in any rigid and inflexible decision-making based upon data traces or outputs that do not consider individual circumstances. A further option to consider would be the involvement of user input into the design of products so that tenants and landlords can shape the systems themselves.

The data input into the systems is potentially more important than the algorithm in terms of outcomes, with the data feeding into the algorithm informing the judgement of risk or decision made. That data should always be available to be checked and challenged for accuracy. This also ensures that judgments are not fully codified in ways that cannot adapt to the circumstances of individuals or that mean that responsibility is handed over to algorithms. All firms and users of risk profiling tools should consider equality impact assessments to ensure

that some groups are not disadvantaged in comparison to others in profiling recommendations and also in the final letting or lending outcomes.

## Chapter 4: Some further ongoing questions identified through the project

The Code Encounters project was able to make visible new questions and issues that are arising with the implementation of algorithms. In addition to the key findings covered in this report, the Code Encounters project has also identified a series of pressing further questions that have emerged from the research. These questions are provided here as an additional resource for shaping future work in the field beyond the reach of the Code Encounters project:

- How will we be able to understand the competing visions of the algorithmic future that are attached to different agendas and aims? And how can we understand how those visions shape and become integrated into the implementation of algorithms in risk profiling and access to housing?
- How can we understand the variegated landscape of automation within the housing sector and the potential inequalities and differences in decisions and outcomes that it might produce?
- How can the variety of range, depth and speed of algorithmic processing be regulated within housing and lending decisions?
- How can we continue to understand the sector as a whole through this ongoing period of transition toward algorithms?
- Where can further interventions be made to ensure a safe, fair and equitable future for housing access if automation takes on greater influence than is already the case?
- What blindspots in decision-making are being created where algorithms are applied or where it is unclear if algorithms have been applied in judgments and decisions impacting access to housing?
- How can we understand the wide range of services, providers, software solutions and products and what algorithmic processing is occurring within them when applied? How can the industry of analytics around housing be accounted for and even regulated?



## Appendix 1: A summary of the three tenure reports

Below are brief summaries of the three other reports from the Code Encounters project, more specific details and support for these findings can be found in the full versions of Reports 2, 3 and 4.

### A summary of the project findings specific to the private rented sector:

- Tenant referencing comprises part of landlord's tenant selection processes, used to mitigate business risks arising from welfare reform, increased regulation and labour market changes. Growing digital data reserves are applied to tenant risk profiling and tenant selection aided by increased automation of administrative processes.
- These data sources help verify tenant's identity and income, and in the case of Open Banking are framed as helping people overcome thin credit files and to provide fairer assessments of affordability, but there are significant data gaps relating to former landlord references and employment contracts that limit full automation.
- Landlords and agents often still place great value in tenants' 'soft attributes' to augment formal tenant referencing and letting decisions, screening many tenants out on affordability but also other qualitative data prior to formal referencing.
- The PRS is home to a diverse range of tenants but the tools struggle with complex tenant circumstances, leading to the exclusion of some or significant human involvement in interpreting data and handling exceptions. Squeezing people through fixed models prompts greater use of conditional lets, such as guarantors and rent in advance, that not all tenants are able to meet.
- These tools highlight the increased need for tenants to be aware of and manage their digital profiles to present themselves well to landlords and agents.

### A summary of the project findings specific to social housing:

- Welfare reform, increased marketisation and rising rents have prompted social landlords to undertake stringent affordability assessments as part of routine pre-tenancy checks.
- Interviews suggest an incomplete shift from using these affordability assessments to exclude households with insufficient income to recasting the assessments as a triage point towards (conditional) lets with tenant support. Exclusions remain, however, and landlords wrestle with reconciling social purpose with overcoming new business risks.
- Applicants can be routed towards debt advice or successful income maximisation checks, assisted by digital platforms. But tenancies are refused, impacting young people and others for whom the benefits, wages or debts meant that even a social rented home was unaffordable.

- Assessment practice varied and would impact decisions at the margins. Many providers were looking to draw in additional data, such as Open Banking, and to automate what are often analogue systems. Digital data and automation create administrative efficiencies, and tenants like the convenience of some approaches, but staff and tenants also value human interaction and relationships.
- Increased digitisation should come after providers review the purpose and practice of affordability assessments, as technology cannot overcome business challenges created upstream with welfare or social housing rents and funding.

## **A summary of the project findings specific to credit risk decisions and digital mortgage lending:**

- Credit bureaus collect data relevant to assess a person's creditworthiness but the data resources have changed over time, moving from community reputation to income, status and default histories, but can now include new resources such as current account turnover, utility bills, stability of mobile phone numbers and email addresses, banking transaction data and digital footprint analysis.
- Large parts of the mortgage lending sector are already highly data-driven and automated with mainstream lending using credit bureau information to verify customer-supplied data and automated property valuations to make lending decisions.
- New technologies like Open Banking, where customers give permission for lenders to access banking account transactions, are evidently becoming increasingly common in other credit lending scenarios but to a lesser extent in mortgage lending,
- The interviews revealed that there are significant barriers to further automation and using new data resources that include large legacy IT systems, regulation, professional resistance and the importance and cost-effectiveness of human oversight to detect fraud or assess lending in non-standard circumstances.
- The drive to automate lenders' back office operations was clear and may improve customer experience, increase speed, create efficiencies and the quality of decision-making. There were, however, mixed views on the strength of the business case for change and some lenders in niche mortgage markets made a virtue of human oversight and manual processes at the margins.

## Appendix 2: Code Encounters project research methods

### Rationale

The Code Encounters project was conceived to examine the constellation of actors that surround the digital tools used to profile tenants and mortgage borrowers in relation to their access to different housing tenures. This enabled the study to examine the full ‘regime of recognition’ (Amoore, 2020) or ‘socio-technical assemblage’ (Kitchen, 2017) connected to the production, operation and impact of the tools.

### Distribution of interviews

The findings presented in the three tenure reports and associated briefings are based on the qualitative insight gleaned from 122 in-depth interviews from national stakeholders, lenders, landlords, letting agents, technology firms, social landlords, consultants, private and social housing tenants and mortgage borrowers. Table 1 shows the distribution of interviews across the different housing tenures.

**Table 1 Breakdown of in-depth interviews**

	Construction	Operation	Impact	Stakeholders	Total
<b>PRS</b>	10	13 (including 7 landlords, 5 agents and 1 insurer) (Landlord survey, n=113)	20 PRS tenants	7	<b>50</b>
<b>SRS</b>	6	15 landlords	15 SRS tenants	3	<b>39</b>
<b>Lending</b>	7 Credit tech firms	9 (including 3 brokers, 4 lenders & 2 consultants)	12 borrowers	3	<b>31</b>
<b>Across Tenures</b>				2	<b>2</b>
<b>Total</b>	<b>23</b>	<b>37</b>	<b>47</b>	<b>15</b>	<b>122</b>

For reference, the interview quotes in the four reports have some self explanatory labels but others are coded as followed: CR Credit risk decision software firms; SH social housing landlords; TR tenant referencing firms; ST social housing tenant; SRS firm, software firms working with social housing landlords; MB mortgage borrower; and Tenant, private rented sector tenant.

### Recruitment -Technology firms constructing digital tools

The technology firms who produce the digital risk profiling tools were directly invited to participate in the research through internet searches of relevant companies or approached using snowballing techniques, where other participants recommended that we speak to firms developing technology in this space. PRS firms were all engaged with tenant referencing and

were at various points on a spectrum from hybrid analogue-digital systems to ones that were almost wholly platform-based, and reflected the whole market of providers. Social housing firms were more disparate, with some offering income maximisation and tenant onboarding tools, to some engaging with triaging and understanding the customer base, and others producing customer management systems. Credit lending firms comprised those offering digital software services to support credit risk decision-making activities including data collection and analysis or comprehensive platforms, alternative credit risk profiling for loan providers, platform mortgage broker services, and consultancy activities. There was some overlap with some lenders designing software in-house.

## **Recruitment - Landlords, lenders, agents and brokers using digital tools**

Private sector landlords and letting agents were recruited to the study in various ways, using direct approaches after internet searches, posts inviting participation on online landlord's forums, and the online survey distributed by the National Residential Landlords Association. The online survey was hosted on the *Qualtrics* platform and obtained 113 useable responses. It asked about landlords' use of digital tools, motivations and some attitudinal questions about their sentiment towards the tools regarding accuracy, confidence, understanding etc. There were several open text boxes from which we derived qualitative data. The rest of the survey was analysed descriptively using SPSS. Landlords ranged from one large national build-to-rent operator to landlords with a single property, but were mostly those with a handful of properties, reflecting the membership base of the organisation used for recruitment.

Social landlords were recruited via direct approaches and via a research invitation circulated by the National Housing Federation, the trade body for housing associations in England. Social landlords were predominantly drawn from the north of England (n=10) and the remainder from the south (n=5), although classification is challenging as some landlords include some housing stock across multiple regions. Some were large-scale providers, others smaller community associations, but were typically medium-sized regional associations, with two local authority housing departments included.

Mortgage lenders and brokers were recruited to the study using direct approaches and snowballing techniques. The mortgage lenders included a large national lender, smaller building societies and specialist lenders, including one buy-to-let lender.

## **Recruitment of tenants and mortgage borrowers - the subjects of the digital tools**

Private rented sector tenants were recruited with the assistance of Generation Rent, a private rented sector tenant advocacy organisation, who circulated the research invitation on our behalf. The research invitation to recruit mortgage borrowers for the study was circulated on our behalf by the Homeowners Alliance. Mortgage borrowers and private tenants were drawn from around England, although London was over-represented. Social housing tenants were identified by a market research company and drawn from London, Birmingham and Manchester in roughly equal measure. Tenants and borrowers were selected if they had moved within the last two years to aid recall of their experiences of risk-profiling and were awarded £20 Amazon vouchers as a thank-you for their participation. Social housing tenants received £30 vouchers as they had proved harder to engage.

## **Analysis**

Interviews were undertaken on Zoom with almost all interview audio files being professionally transcribed with the remaining three digitally transcribed, checked and corrected by the researchers. Thematic analysis was undertaken supported by Nvivo. The analysis was informed by the literature review but researchers were alive to many issues that arose directly from the data.

## **Ethics**

Ethics approval for the research was obtained from the University of York.