Finance – Enabling Decision Making through Scenario Testing

Data Analytics Lab

June 2024

1 Contents

2 Executive Summary

The current financial environment in policing is a well-documented issue. Locally in the West Midlands the West Midlands Police (WMP) is required to find significant savings in the medium term.

Given this financial pressure, it is crucial to understand the impact on departmental performance and costs in the future resulting from planned (and unanticipated) changes. This project aims to provide information to feed into decision making by of providing an idea as to the costs of potential changes, their impact on performance and the number of people as well as vice versa.

In order to help inform decisions, models have been developed to ensure logical results (due to business logic) for scenario testing. This was achieved by selecting appropriate modelling methodologies, features, and targets based on a thorough understanding of the data and the financial processes that generate it. This understanding was built through meetings with subject matter experts (SMEs) and detailed data exploration. The models interlink to create a cohesive system. Due to the nature of these links and the models, it is possible to navigate this system in various directions, enabling the tool to address numerous "what if?" questions.

3 Introduction

The current financial environment in policing is a well-documented issue and was highlighted by BBC panorama in Jan 2024[1]. The program noted that over the past decade, a period of austerity, where police numbers have decreased by 20,000, there has been a 65% increase in recorded crime[2]. Locally, in the West Midlands, where the population grew by 214,000 between 2011 and 2022[3], West Midlands Police (WMP) is required to find significant savings in the medium term. In June 2023, the Police and Crime Commissioner (PCC) stated, "This year, West Midlands Police faced £28 million in funding cuts. Next year, it faces further cuts of £28 million."[4]

Given this financial pressure, it is crucial to understand the impact on departmental performance and costs in the future resulting from changes in:

- Financial decisions such as department budget and employee numbers.
- Other financial elements like inflation, national insurance and pension contribution requirements.
- Departmental demand, i.e. number of incidents for the response function to attend.
- Performance targets; for example, increases in areas identified as needing improvement in external and/or internal reviews, or directed by government policy.
- Cost drivers, i.e. cost spikes generally seen from an increase in overtime due to summer demand.

To address these challenges, a scenario testing tool has been developed that integrates departmental costs, employee numbers, demand, and performance metrics. This tool provides monthly forecasts for the next 12 months (a detailed, short-term forecast) and annual forecasts for the next five years (the medium-term forecast).

The primary concept behind the system is to establish a connection between departmental costs, employee numbers, and performance or output, as illustrated in Figure 1. This system operates multi-directionally, allowing targets to be set for either costs, employee numbers, or performance, with the other variables being estimated accordingly by the system.

---

[1] https://www.polfed.org/news/blogs/2024/bbc-panorama-highlights-consequences-of-under-funding-police/

[2] Intimating a causal connection (though not necessarily estimating one).

[3] ONS Population Estimates / Projections accessed via NOMIS 31/05/2024.

[4] https://www.westmidlands-pcc.gov.uk/strategic-policing-and-crime-board/agendas-minutes-reports/ Agendas, Minutes & Reports - West Midlands Police & Crime Commissioner (westmidlands-pcc.gov.uk) (Strategic Police and Crime Board Oct 2022 Agenda Item 6 – Medium Term Financial Plan, p.4)

Figure 1: Basic relations

4 The data and preparation

4.1 Data

4.1.1 Finance

Historical costs were obtained from WMP's Finance System, comprising monthly transactional data that tracked every movement of money between accounts, both internally and externally. This data covered every month from April 2017 to March 2024, six full financial years, or 72 months. Using financial markers, such as account and transaction types, these transactions were categorised into operational costs (OPEX) and capital costs (CAPEX). For the analysis, capital costs were excluded because they are not easily forecastable based on historical trends, being heavily influenced by current force policy and government funding.

The financial markers were also utilised to identify the relevant departments for each transaction and to break down these costs within departments. This included components such as basic pay (including national insurance and pensions), overtime pay, other people-related costs (i.e. allowances and expenses), and other expenses (i.e. charges and licenses).

Due to the nature of transactional data, which cannot be altered, extensive data cleaning was required. A common issue was the incorrect assignment of transaction markers, necessitating corrections at a later date. For instance, if £50,000 was mistakenly paid from account A instead of account B, the records would initially show a £50,000 expenditure from account A. Subsequently, £50,000 would be transferred from account B to A to rectify the mistake, resulting in a net spend of £0 from account A. While this corrects the annual net spend, it distorts the monthly records.

To address this, a process was established to identify and correct such discrepancies. This process detects instances where funds are moved out of an account and then returned, and it adjusts the records by deleting the incorrect transactions and assigning the cost to the correct account. For example, in the scenario described, the process would identify the £50,000 moving out and back into account A and remove both transactions, leaving the cost correctly attributed to account B. The impact of this data cleaning is illustrated in Figure 2.

It should be noted that in any large organisation there will be a need to journal transactions between accounts; sometimes where these have been posted to an incorrect charge account, but also commonly to vire funds between departments to ensure that expenditure and income are correctly recognised and to ensure that expenditure is adequately budgeted for.

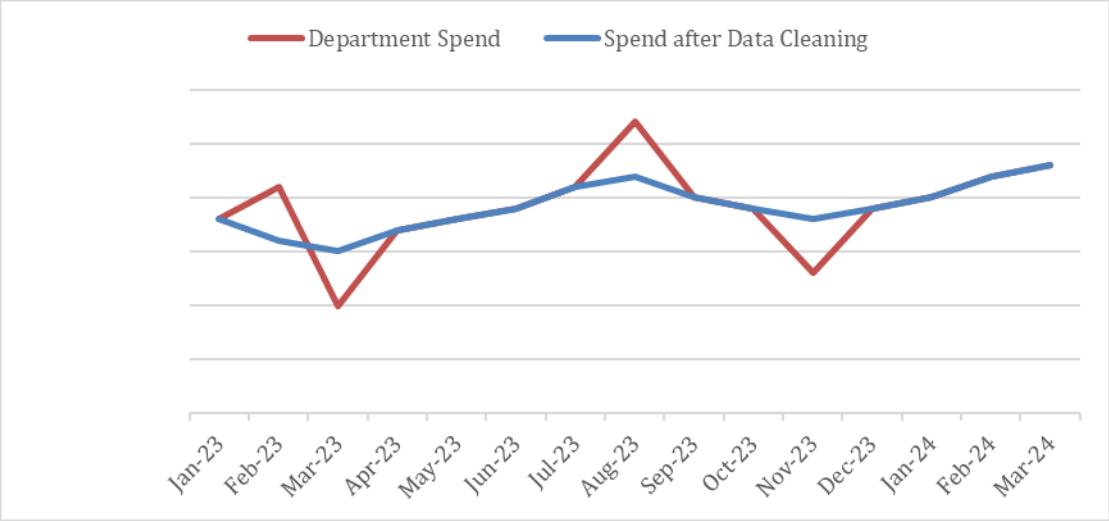


Figure 2: Accounting for swaps between budgets

4.1.2 People Data

Historical numbers of employee's data are embedded within the financial data, as people costs are linked to specific departments. This information is recorded as Full-Time Equivalent (FTE) for each employee, with a base FTE of 40 hours per week for officers and 37 hours per week for staff. In cases where an employee did not work a full month in one department, the FTE did not accurately reflect this, though the amount paid did.

To correct the FTE in these instances, discrepancies were identified by comparing each employee's monthly pay per FTE to those of similar ranks. If (for any particular month) an employee's pay per FTE was less than 80% of the median, the FTE for that month was adjusted by dividing the actual pay by the median pay per FTE.

The ratio of officers to staff within a department was derived from the FTE data.

Overtime was recorded in hours. To calculate the total hours of people resources in a month, FTE was multiplied by 52/12 (to convert weekly hours to monthly hours) to calculate the base hours and then added to the overtime hours.

4.1.3 Demand and Performance

Many of WMP's IT systems have been utilised to quantify department demand and performance. These include systems like:

- Avaya (call handling): to obtain call demand and performance.
- Controlworks and Oasis (command and control): to capture force response demand and performance as well as dispatch information.
- Connect (crime and custody system) for custody and investigation data.
- Many others like Compact (missing persons), etc.

The data in these systems has been used to understand demand and our response to that demand at a departmental level. Data relating to individuals is aggregated for the purposes of this tool.

Where existing performance metrics for a department existed, the data process and calculation has been kept consistent with other performance related work within WMP (where applicable).

4.1.4 Historical National Insurance and Pension

To allow for future changes in National Insurance (NI) and pension contributions to be tested, the historical uplifts on basic pay to cover these costs needed to be understood. Due to significant differences between officers and staff, particularly regarding pensions, they were analysed separately.

Using financial data, the historical average uplifts were quantified by focusing on the most common police and staff ranks, thereby eliminating the impact of changing rank mixes over time. We tracked the percentage of basic pay attributed to NI and pension contributions. This analysis resulted in Figure 3, which illustrates that officer NI contributions are slightly higher than those of staff due to higher average pay, and their pension contributions are significantly higher. While NI contributions have remained stable over the period, pension contributions have experienced substantial step increases.

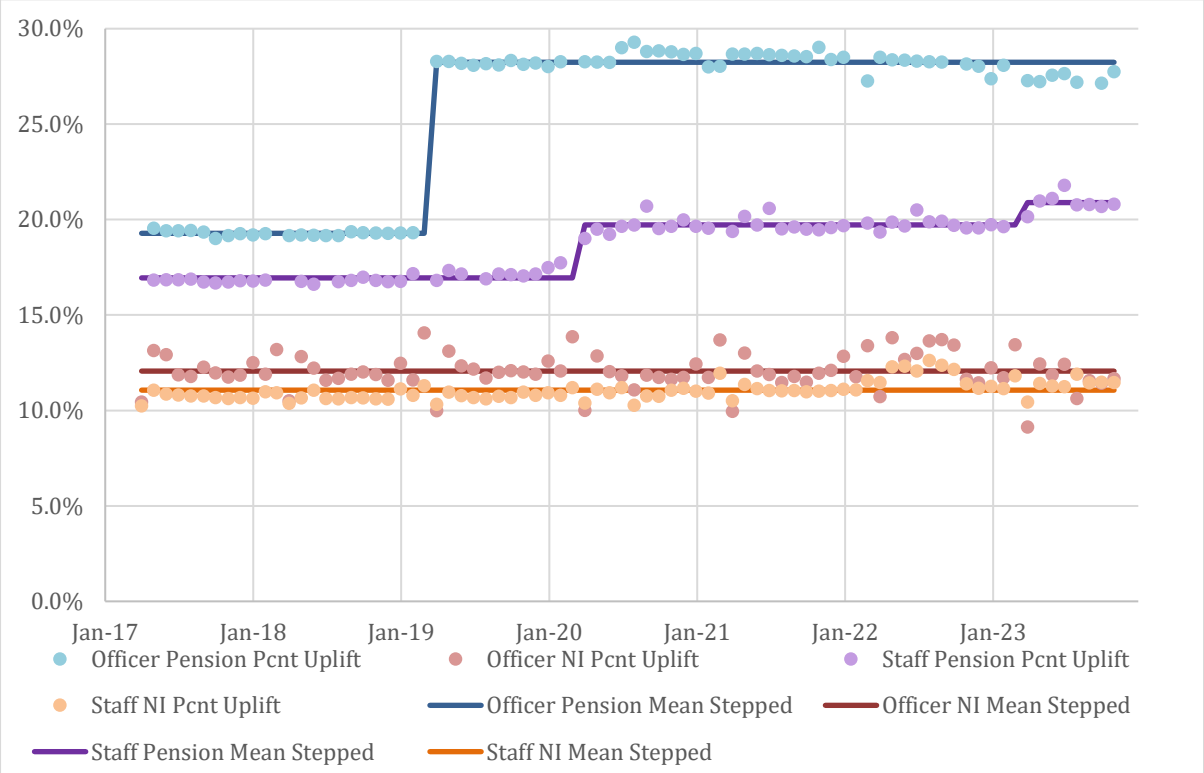


Figure 3: NI and pensions

4.1.5 Inflation

To facilitate scenario testing for future inflation possibilities, it was necessary to adjust all costs in the data to the same time period for the analysis. March 2024 was chosen as the baseline, as it was the latest available data. Given that different costs, such as officer

and staff pay, have grown at different rates over time, bespoke inflation profiles were required.

It was decided to base other costs on the government's primary inflation measure, the Consumer Price Index (CPI). However, new profiles were needed for staff and officer-related costs. These profiles were created by tracking the basic pay of the most common staff and officer ranks over time, as illustrated in Figure 4. These figures were then converted into inflation indexes, as shown in Figure 5. The data indicates that staff have received larger pay increases compared to officers over the period, though both have increased less than CPI. This shows that general inflation is outpacing wage growth, a known issue in the UK economy.

Using these three inflation profiles, all costs were adjusted accordingly. These inflated costs formed the basis for the analysis.

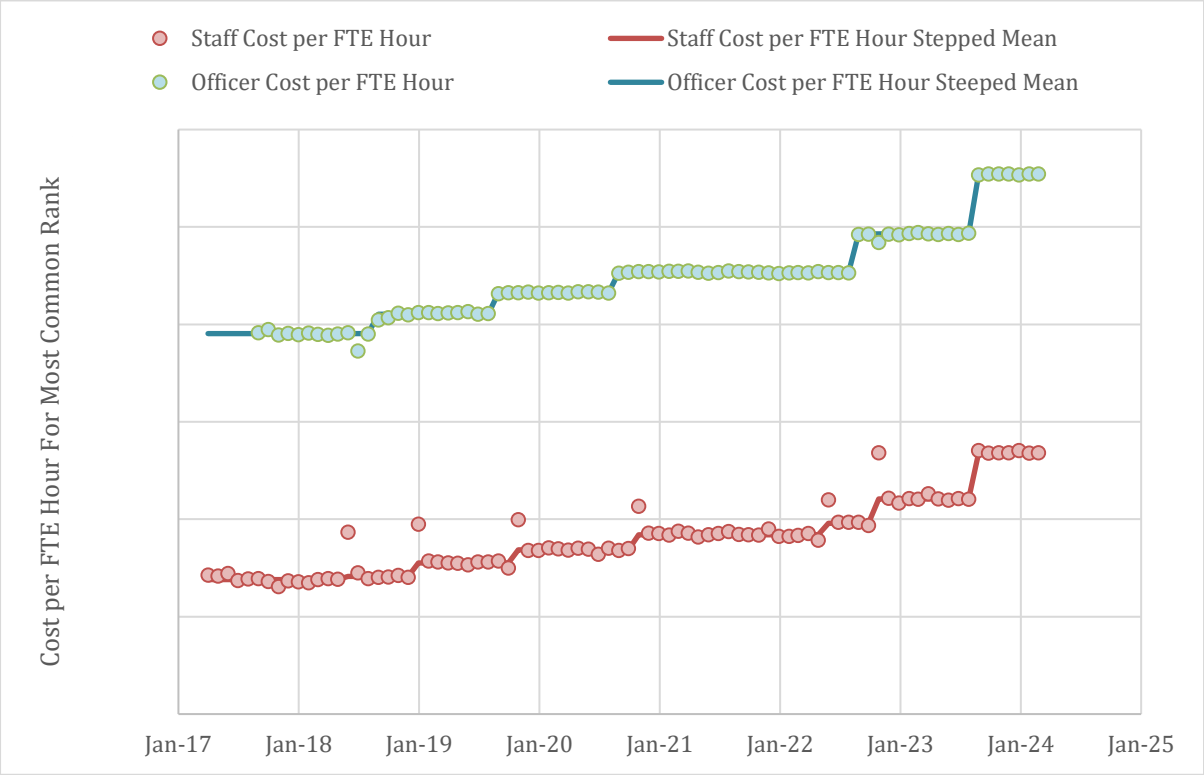


Figure 4: Pay costs over time

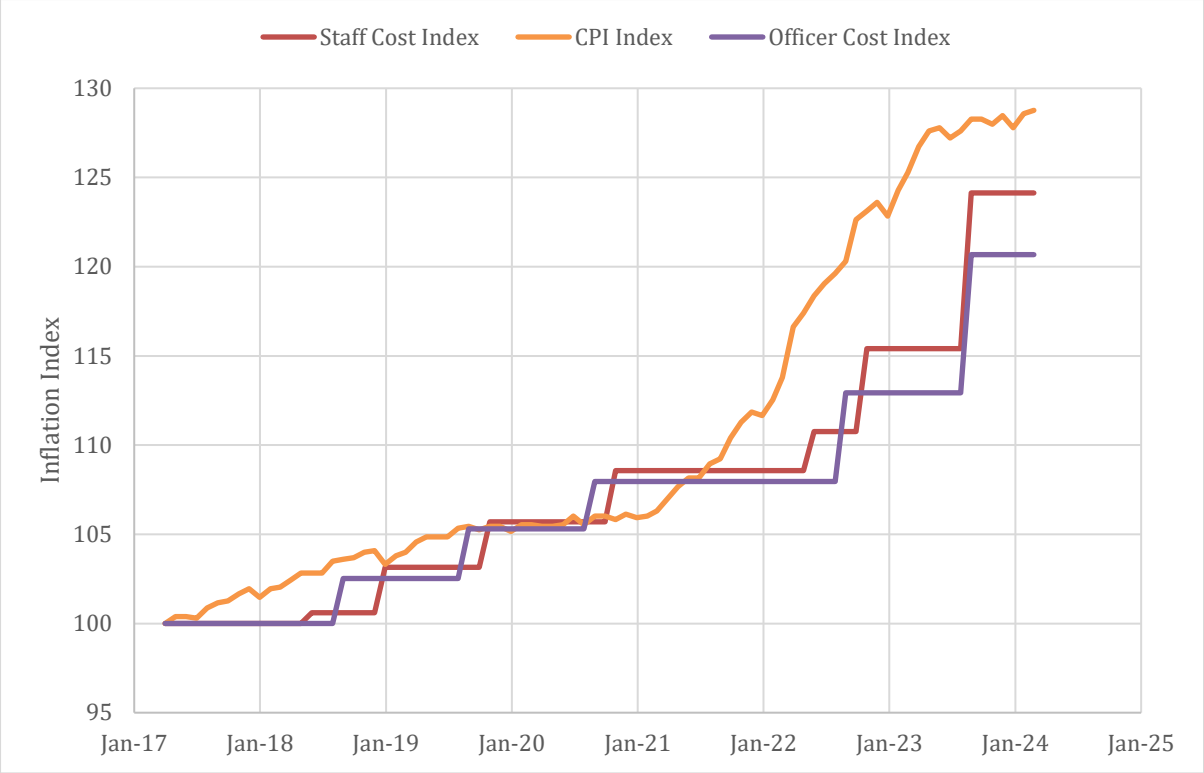


Figure 5: Inflation over time

5 Methodology

5.1 System Design

A comprehensive system of models has been developed to interlink the elements of costs, employee numbers, performance, and demand. This system includes three interconnected models for each department:

- Cost estimation based on the numbers of employees recorded as FTE.
- Overtime hours calculation.
- Performance estimation based on the total number of people hours and demand. If performance metrics were not applicable for a department, the number of people hours was linked to output where relevant.

The system is duplicated for both monthly and Financial Year (FY) aggregated data. The system of models based on the monthly data are used to make a detailed short-term forecast for the next 12 months. The yearly data is used to make medium-term forecasts covering the next five years.

Figure 6 illustrates this system, showing the possible directions of influence with arrows. The diagram highlights only the main features; the actual models incorporate additional elements such as NI and pension uplifts, monthly seasonality, and average employee ranks.

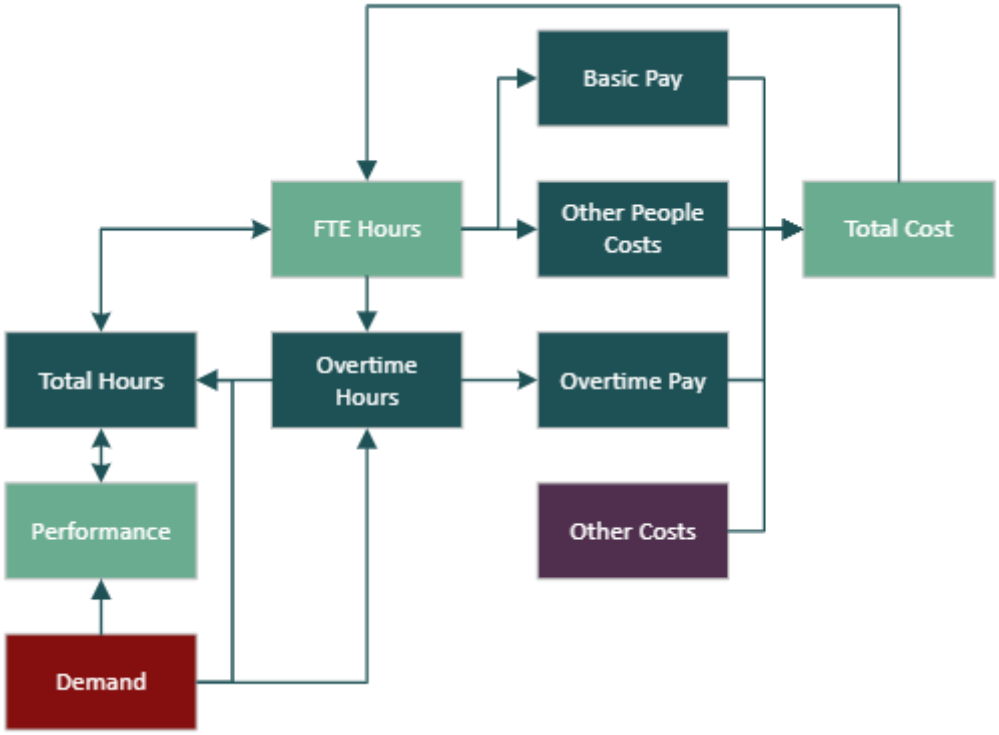


Figure 6: The system of relations

The system allows the inputting of the number of people, budget or performance target and it estimates the other features.

Within this system, if a factor is known:

- **Budget:**
    - See Figure 7
    - FTE hours can be estimated.
    - Overtime hours can be projected.
    - The expected number of people hours can be calculated.
    - With this and a demand forecast, expected performance can be estimated.

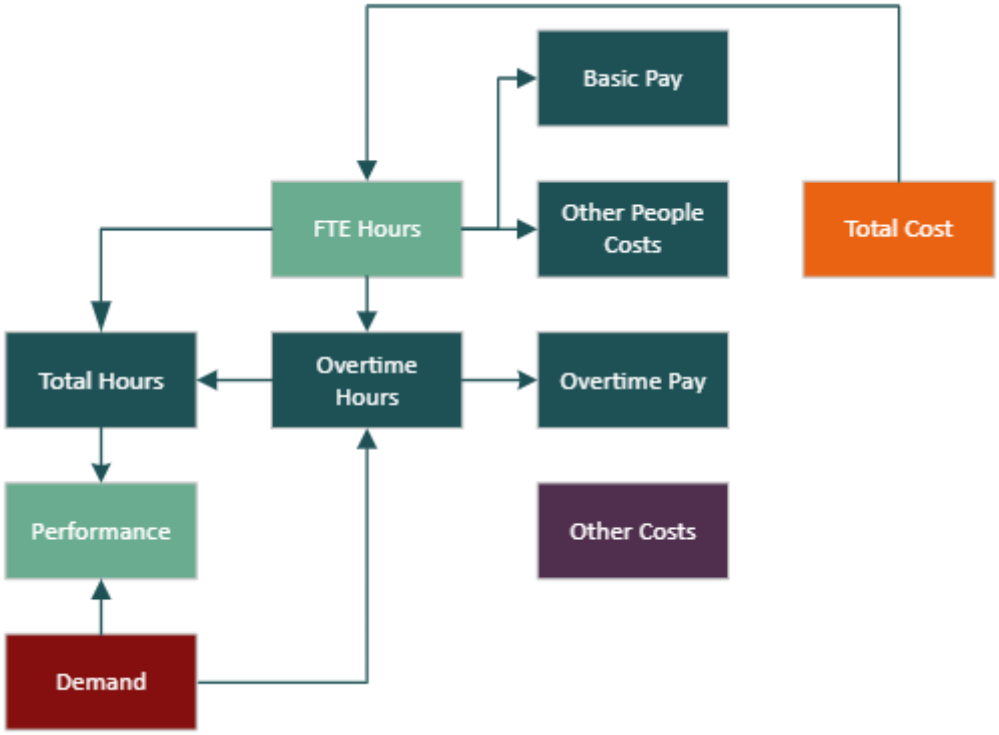


Figure 7: Budget known

- **Number of Employees:**
    - See Figure 8
    - Overtime Hours can be projected.
    - Combined with the number of people, the total people hours can be determined.
    - With this and a demand forecast, expected performance can be estimated.
    - Employee numbers are used to calculate basic pay and other people costs.
    - Estimated overtime hours used to calculate overtime pay.

- Other costs estimated.
- All Costs summed to determine the total cost.

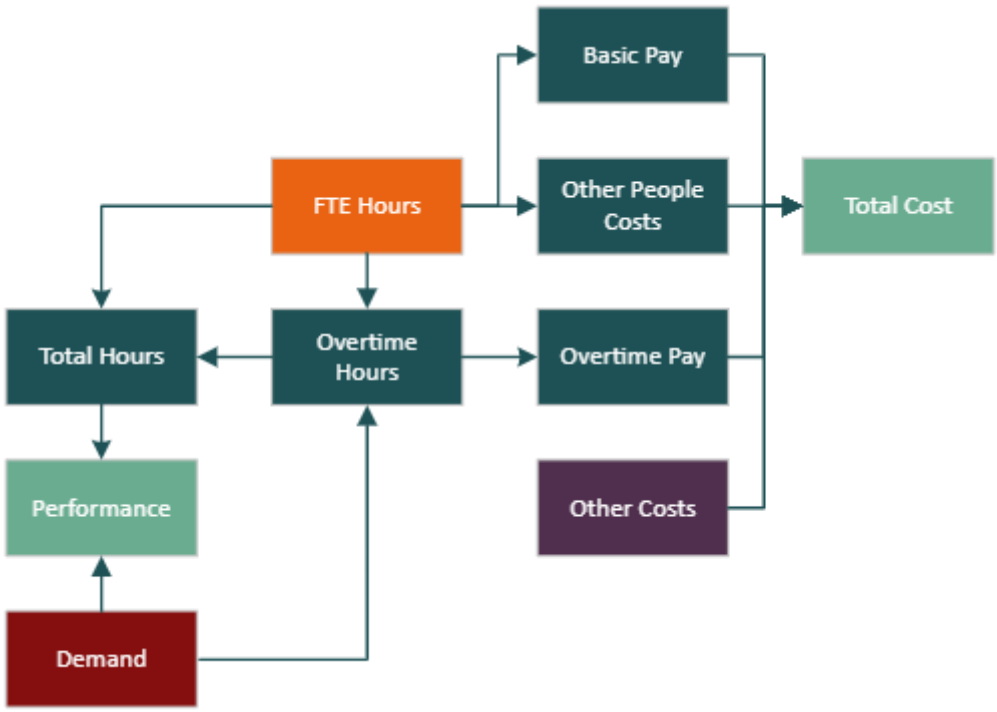


Figure 8: FTEs known

- **Performance:**
  - See Figure 9
  - Given the demand, people hours can be estimated.
  - Then number of employees.
  - The overtime hours.
  - Finally, the costs are calculated as before.

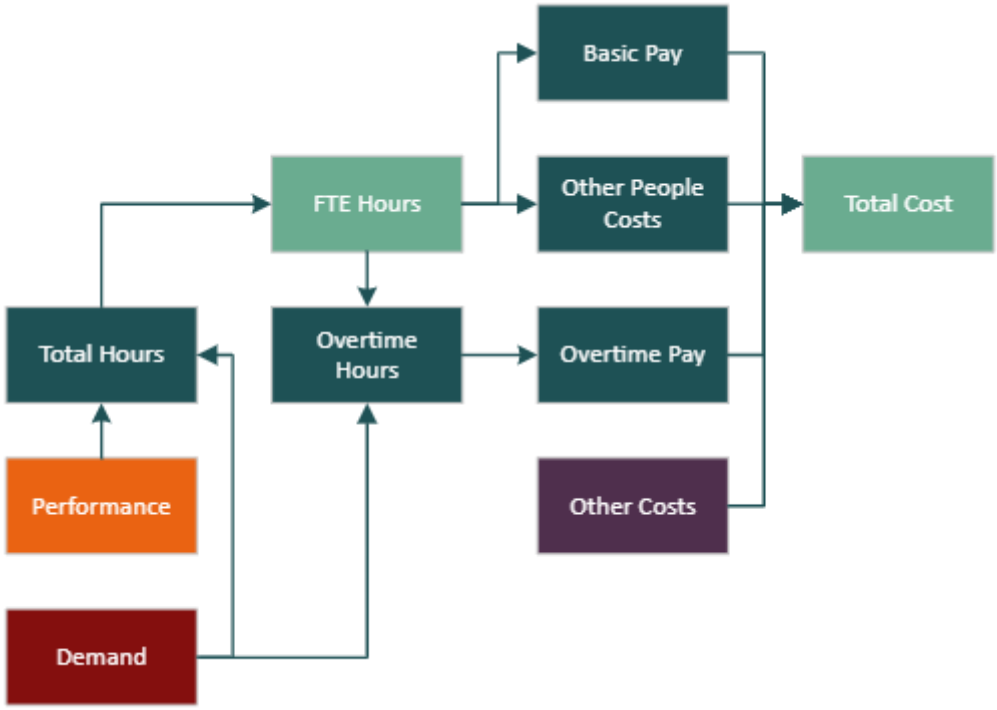


Figure 9: Performance known (required)

- **Output** (when performance not applicable):
    - Unlike performance this is not linked to demand, just to people hours.
    - If the required output is known, people hours can be estimated.
    - Then all other elements as before.

This provides a high degree of flexibility and answers many "what if" questions. These "what if" questions are answered with both detailed short-term forecasts (monthly, 12 month forecast) and medium-term forecasts (yearly, five years). For example:

- What would be the impact on performance if we moved 50 officers from one function to another, increasing budget of one at the expense of another?
- What are the cost implications of a staffing uplift, and what performance improvements can we expect?
- How much would it cost to improve performance from X to Y?
- How much more would it cost to maintain performance if demand increased by 10%?
- What would be the cost implication if NI contributions increased by 2 percentage points.

5.2 Models

Multi-linear models, incorporating any necessary transformations, were employed to quantify relationships and so enable predictions. This approach was chosen for several reasons:

- Simplicity of deployment: linear models are straightforward to implement in various software applications, such as Excel or Qlik (dashboard software). Given that the tool is intended for scenario testing, it was crucial for the model predictions to be quickly calculable within the developed tool.
- Explainability: linear models provide clear and interpretable results.
- Safer Extrapolation: compared to models like tree-based approaches, linear models tend to offer safer extrapolation of predictions[5].
- Customizable Model Formulas: the ability to specify the model formula ensures alignment with real-life scenarios (i.e. financial and business logic are the main drivers).
- Weighted Fitting: All models were fitted using weights;

Considering the time-series nature of the data, more recent data was given higher weight compared to older data, ensuring the models are more reflective of recent trends while still incorporating lessons from past data. Weights ranged from 0.5 to 1, with the most recent month (Mar-2024) assigned a weight of 1, and older data (Apr-2017) assigned a weight of 0.5. A linear relationship was used to determine weights for the intervening months. Similarly, for fiscal year models, FY17/18 was given a weight of 0.5 and FY23/24 a weight of 1.

These weights also helped minimise the impact of any remaining outliers in the data. Extreme outliers in the target feature, identified as being more than 4 standard deviations from the mean, were assigned half their original weight. This approach reduced the influence of outliers on future predictions without completely disregarding them.

The system and modelling approach are the same for the FY and monthly aggregated models, except from the use of the month feature.

Monthly and FY data and model fits for "Force Contact - Call Handling" are presented in the appendix by way of example. These departments have been used in this report because they are two of the largest in terms of expenditure and have well-developed performance metrics that are subject to internal and external scrutiny.

5.2.1 Cost Models

Costs were divided into basic pay (including NI and pension), overtime pay, other people costs and other expenses. By segmenting the costs into distinct categories, the system provides more detailed cost estimates and ensures that the models built are logical and

[5] E.g. if there are small movements outside of the “experimental region” (the space within which previous data have been located).

relevant. Individual models were constructed using features directly related to the specific costs. For instance, modelling total costs based on FTE hours and overtime hours often yields less logical results compared to combining two separate models: one for basic pay based on FTE hours and another for overtime expenditure based on overtime hours.

To ensure that features accurately explain the data, particularly in scenarios such as basic pay where nearly all of the variability is attributed to the number of employees (FTE) (reflecting the actual financial process), the modelling was carried out in stages. Initially, a primary model was developed using key features identified through discussions with SMEs. Subsequently, a second model was created to account for the residuals from the first model by incorporating additional features. The final model combined these two stages, ensuring comprehensive and logical cost estimation.

5.2.1.1 Basic Pay Model

The target feature consists of basic pay for officers and staff, including associated NI and pension contributions. Understanding that all employees receive a basic salary, with additional uplifts for NI and pensions, the following equation was developed:

$$\text{Basic Pay} = (FTE_{coef} * \text{FTE}) * (1 + \text{pen}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{pen}_{\text{officer}} * \text{pcnt}_{\text{officer}}) * (1 + \text{NI}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{NI}_{\text{officer}} * \text{pcnt}_{\text{officer}})$$

In this equation, the salary pay is first estimated by FTE element (FTE_{coef}* FTE), which is then multiplied by the NI and pension uplifts, as detailed in earlier. Since NI and pension uplifts differ for officers and staff, a weighted uplift is calculated based on the ratio of officers to staff within the department. This formula excludes an intercept or a lagged basic pay feature to ensure that the cost is accurately attributed to FTE, making future predictions logical.

To improve model accuracy, a secondary model was constructed to predict the residuals from the first model. This secondary model includes the average rank of employees in the department (as higher average rank correlates with higher cost per FTE) and monthly variations due to minor discrepancies in financial accounting processes:

$$\text{Basic Pay Model Error} = rank_{coef} * \text{rank} + month_{coef} * \text{month}$$

The error model does not include an intercept, as the month feature is one-hot encoded. Combining both models, the final model is:

$$\text{Basic Pay} = \left(FTE_{coef} * \text{FTE}\right) * (1 + \text{pen}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{pen}_{\text{officer}} * \text{pcnt}_{\text{officer}}) * (1 + \text{NI}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{NI}_{\text{officer}} * \text{pcnt}_{\text{officer}}) + rank_{coef} * \text{rank} + month_{coef} * \text{month}$$

This combined model ensures comprehensive and logical cost estimation. Model fits can be seen in the appendix.

5.2.1.2 Overtime Pay Model

The logic follows that of the basic pay model, except FTE is replaced by overtime hours. Unlike basic pay, overtime is not subject to pension contributions and thus they are not included. The equation is as follows:

Overtime Pay
$= (Hours_{coef} * \text{Hours}_{\text{OT}}) * (1 + \text{NI}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{NI}_{\text{officer}} * \text{pcnt}_{\text{officer}})$

The error model accounts for the average rank of employees and monthly variations:

Overtime Pay Model Error $= rank_{coef} * \text{rank} + month_{coef} * \text{month}$

Combining these, the final model is:

Overtime Pay
$= \left(Hours_{coef} * \text{Hours}_{\text{OT}}\right) * (1 + \text{NI}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{NI}_{\text{officer}} * \text{pcnt}_{\text{officer}})$
$+ rank_{coef} * \text{rank} + month_{coef} * \text{month}$

5.2.1.3 Other People Costs Model

Similar to basic and overtime pay, but additional people costs are not subject to pension or NI contributions. The relationship to FTE is modelled as follows:

$Other\ People\ Costs\ Model = FTE_{coef} * FTE$

The error model accounts for the average rank of employees and monthly variations:

$Other\ People\ Costs\ Model\ Error = rank_{coef} * \text{rank} + month_{coef} * \text{month}$

Combining these, the final model is:

$Other\ People\ Costs\ Model = FTE_{coef} * FTE + rank_{coef} * \text{rank} + month_{coef} * \text{month}$

5.2.1.4 Other Costs

As these costs are not related to the number of people in the department and tend to be minor, it was decided to model them using a general linear trend over time, with additional terms to account for monthly fluctuations:

Other Costs $= Timestep_{coef} * \text{Timestep} + month_{coef} * \text{month}$

Break points, representing step changes over time, were identified in the data and incorporated as features in the model. If a break point was found, the updated formula would be:

Other Costs $= Timestep_{coef} * \text{Timestep} + month_{coef} * \text{month} + BP1_{coef} * \text{BP1}$

5.2.1.5 Total Cost

To obtain the total cost, we sum the estimates from all the models:

$Total\ Cost = Basic\ Pay + Overtime\ Pay + Other\ People\ Costs + Other\ Costs$

This full formula is:

Basic Pay
$= \left(FTE_{Basic\ coef} * \text{FTE}\right) * (1 + \text{pen}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{pen}_{\text{officer}} * \text{pcnt}_{\text{officer}})$
$* (1 + \text{NI}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{NI}_{\text{officer}} * \text{pcnt}_{\text{officer}})$
$+ \left(Hours_{OT\ coef} * \text{Hours}_{\text{OT}}\right) * (1 + \text{NI}_{\text{staff}} * (1 - \text{pcnt}_{\text{officer}}) + \text{NI}_{\text{officer}} * \text{pcnt}_{\text{officer}})$
$+ (month_{Basic\ coef} + month_{OP\ coef} + month_{OT\ coef}) * \text{month} + (rank_{OT\ coef}$
$+ rank_{OP\ coef} + rank_{Basic\ coef}) * \text{rank} + FTE_{OP\ coef} * FTE + Timestep_{coef} * \text{Timestep}$
$+ month_{coef} * \text{month} + BP_{coef} * \text{BP}$

This formula can be rearranged to isolate the FTE element, allowing FTE to be estimated from the costs.

5.3 Overtime Models

As overtime expenditure is primarily influenced by the number of overtime hours (the basis of the model), a forecast of overtime hours is required. Analysis indicated that the number of bank holidays (BH) and demand were key drivers of overtime hours. Additionally, due to the potential impact of Covid-19 on overtime needs, the Oxford Covid-19 Stringency Index was included in the model (for the purposes of controlling for the effects of CoVID on the empirical relationships rather than using moving forward).

The number of overtime hours was also shown to be linked to the number of employees in the department. This relationship was sometimes positive and sometimes negative. A positive relationship occurs when departments have overtime available but no staff to do it, while a negative relationship occurs when overtime is necessary due to a shortage of employees.

WMP has undergone significant operational changes in the last year especially regarding overtime. The majority of these changes took effect at the beginning of April 2023, so a change flag was included (0 before, 1 from April 2023 onwards).

The resultant model is:

Overtime Hours
$= FTE_{coef} * \text{FTE} + demand_{coef} * \text{demand} + BH_{coef} * \text{BH} + covid_{coef} * \text{covid} + org_{coef}$
$* \text{org} + month_{coef} * \text{month}$

5.4 Performance/Output Models

The performance of a department, where applicable, is related to resource availability (FTE) and demand. A positive relationship between resources and performance is expected, meaning an increase in resources should lead to improved performance. Conversely, demand is expected to negatively impact performance, as increases in demand typically lead to decreased performance (primarily due to fewer resources). The relationship between demand and performance is taken as being one-directional; there is no clear-cut mechanism / effect to predict future demand based on performance[6].

[6] Over the shorter term at least; increased performance may lead to a reduction in crime levels over a longer time period in which case future demand could be related to performance.

During model fitting, it was found that taking the log10 of the predictive features for FTE and demand improved the model fits and created the expected relationship of diminishing returns. This means that each additional unit of resources (hours of employee time) results in a smaller performance improvement compared to the previous unit. Diminishing returns are a common phenomenon between resources and performance and can occur for several reasons, such as a skewed demand profile with peaks and troughs over time, which is common in WMP.

Since performance is related to the total amount of resources, this includes both FTE and overtime hours. FTE, being the number of hours per week, is converted into expected hours per month by multiplying by $52/12$. This is then added to the overtime hours to get the total number of people resource hours. Other features included are Covid-19 (due to its impact on productivity) and flags designating IT system changes if step changes were noticed in the data at these times.

This leads to the following equation:

$$\text{Performance} = hours_{coef} * \log10(\text{hours}) + demand_{coef} * \log10(\text{demand}) + covid_{coef} * \text{covid}$$

For example, for Force Contact – Calling Handling, this becomes:

$$\%\ \text{Calls 999 Answered in 10 Seconds} = hours_{coef} * \log10(\text{hours}) + demand_{coef} * \log10(\text{Num 99 Calls Answered per Day}) + covid_{coef} * \text{covid}$$

Sometimes demand is more complex than a single feature. For instance, for Force Response, demand is a function of the number of incidents they need to attend and the time spent at each incident. Therefore, both features are included with an interaction term in the model. This leads to the equation:

$$\%\ \text{P1 \& P2 Incidents Arrived in Time} = hours_{coef} * \log10(\text{hours}) + demand_{coef1} * \log10(\text{Num P1 and P2 Incidents Arrived per Day}) + demand_{coef2} * \log10(\text{Mean Mins Busy per Incident}) + demand_{coef3} * \log10(\text{Num P1 and P2 Incidents Arrived per Day}) * \log10(\text{Mean Mins Busy per Incident}) + covid_{coef} * \text{covid}$$

When performance metrics are not applicable for a department, output can be used as an alternative. This approach removes demand from the relationship but allows us to still see the impact of changes to a department's budget, even if they have no performance metrics. An example of this is the Professional Standards Department (PSD), where the number of cases closed per month is related to the number of people:

$$Num\ Cases\ Closed\ In\ Month = hours_{coef} * \log10(\text{hours}) + covid_{coef} * \text{covid}$$

It is possible to rearrange these models to isolate FTE, making it possible to predict FTE based on a desirable performance target. This is done by using any of the above models, replacing the people hours element with its calculation (FTE*52/12+Overtime Hours), then replacing the overtime hours with the model formula for them, and finally rearranging the equation.

5.5 Summary

The above selection of models has been developed to ensure logical results (due to business logic) for scenario testing. This was achieved by selecting appropriate modelling methodologies, features, and targets based on a thorough understanding of the data and the financial processes that generate it. This understanding was built through meetings with SMEs and detailed data exploration. The models interlink to create a cohesive system. Due to the nature of these links and the models, it is possible to navigate this system in various directions, enabling the tool to address numerous "what if?" questions.

6 Tool GUI Development

It was decided to build the tool in Excel[7] due to the numerous possible inputs, as previous experience found that dashboarding software currently in use is not suitable for such situations. The tool includes both the 12-month monthly and five-year yearly forecasts for all departments. It offers several adjustable features:

- General Adjustments:
    - Staff and officer NI and pension uplifts. As these elements were included within the cost calculation models, they can be altered in the forecasts.
    - Inflation rates, separate for general, staff and officer-related costs. As all costs were related to Mar-2024, future inflation is entered as change expected from this date.
- Department-specific adjustments:
    - FTE hours, performance (or output) or budget (depend on which tool determines the others)
    - Demand
    - Officer/staff mix
    - Mean employee rank

Outputs are provided in detailed tables, summary tables and graphically (timelines).

The tool would be available for relevant people within the Finance department.

[7] The empirical relations between variables are estimated in specialist machine learning / statistical software and the results are "hard-coded" into Excel.

7 Testing

Given the scenario-testing nature of this system of models, extensive testing has been conducted. This ensures sensible results, such as adding one extra employee per department increasing the required budget by a reasonable amount to cover costs such as basic pay, NI, and pensions. The mean budget increase per month was £5,190, ranging from £3,131 for probationers (officers in training with low average salaries) to £8,897 for members of the Command Team (high average salaries).

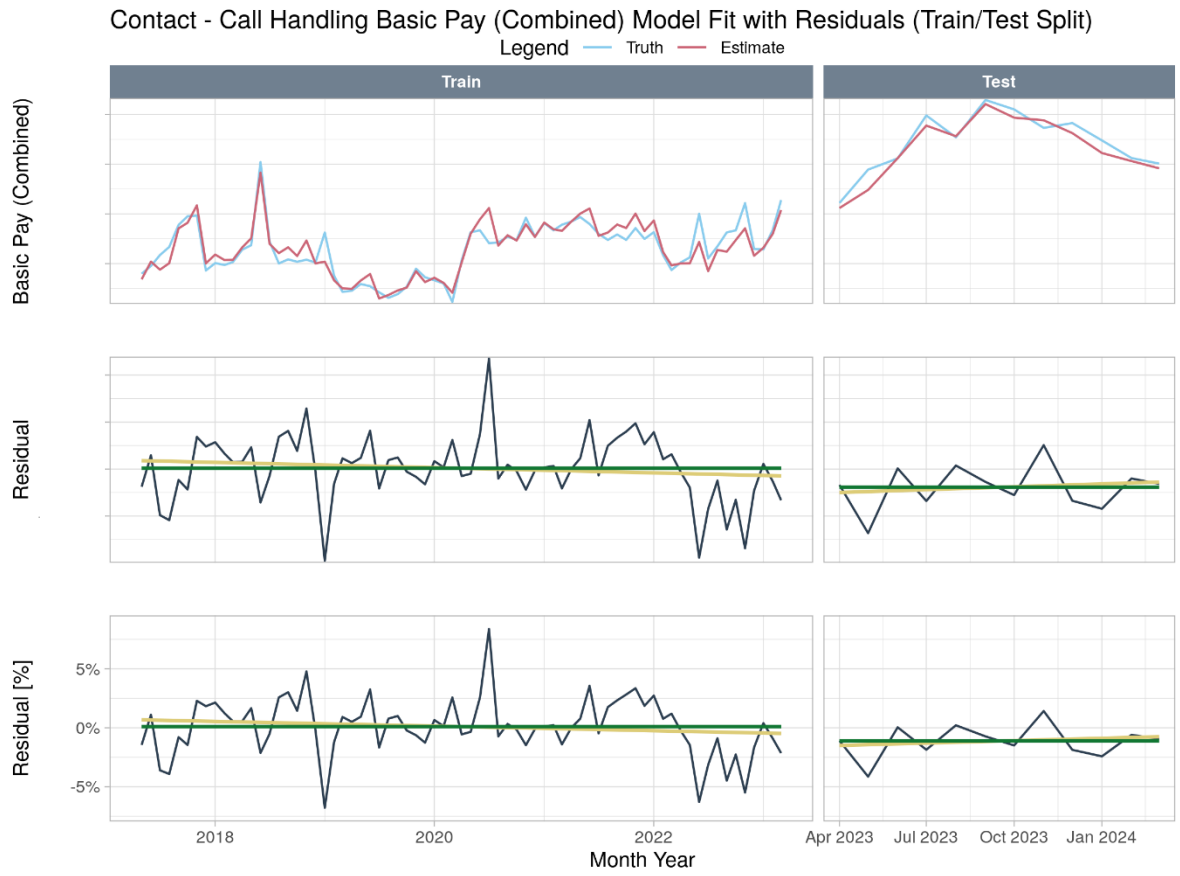
Other aspects tested include ensuring logical relationships. For example, increasing the number of people in a department should correspondingly improve performance (a positive relationship). For example, for Force Contact – Call Handling, adding one extra FTE to Mar 24 values (0.32% increase) will increase departmental costs by £4,717 (0.36%) and performance by (0.19%).

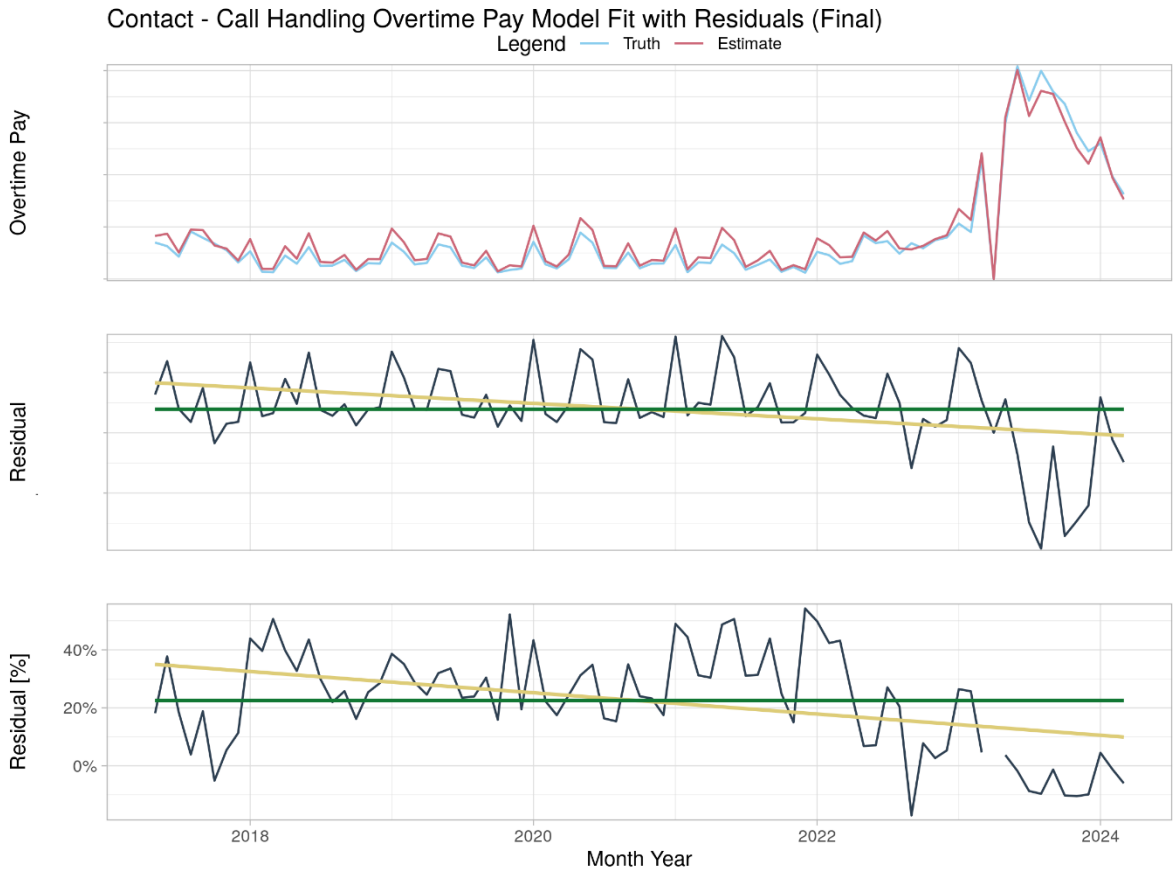
Meetings with SMEs and future users of the tool have helped ensure the general level (in terms of amounts) and sensibility of the results.

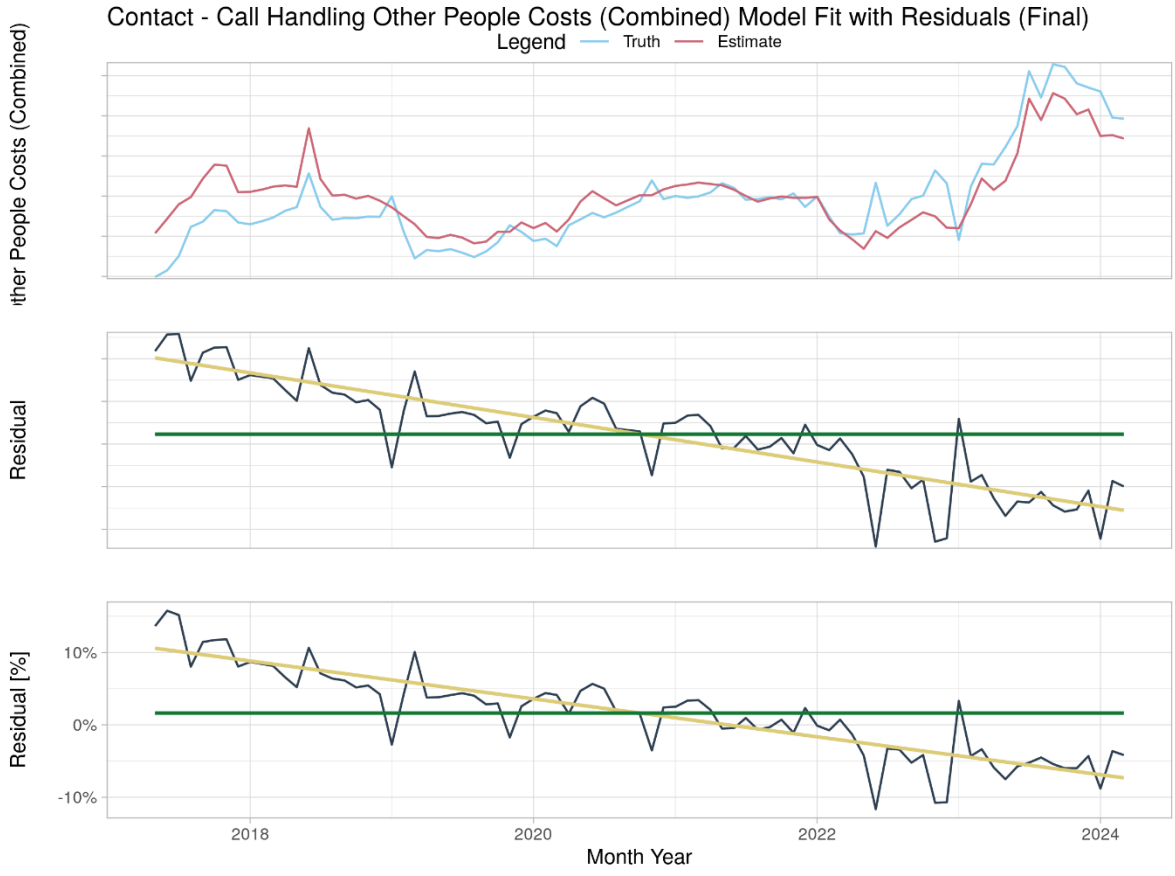
8 Future Maintenance

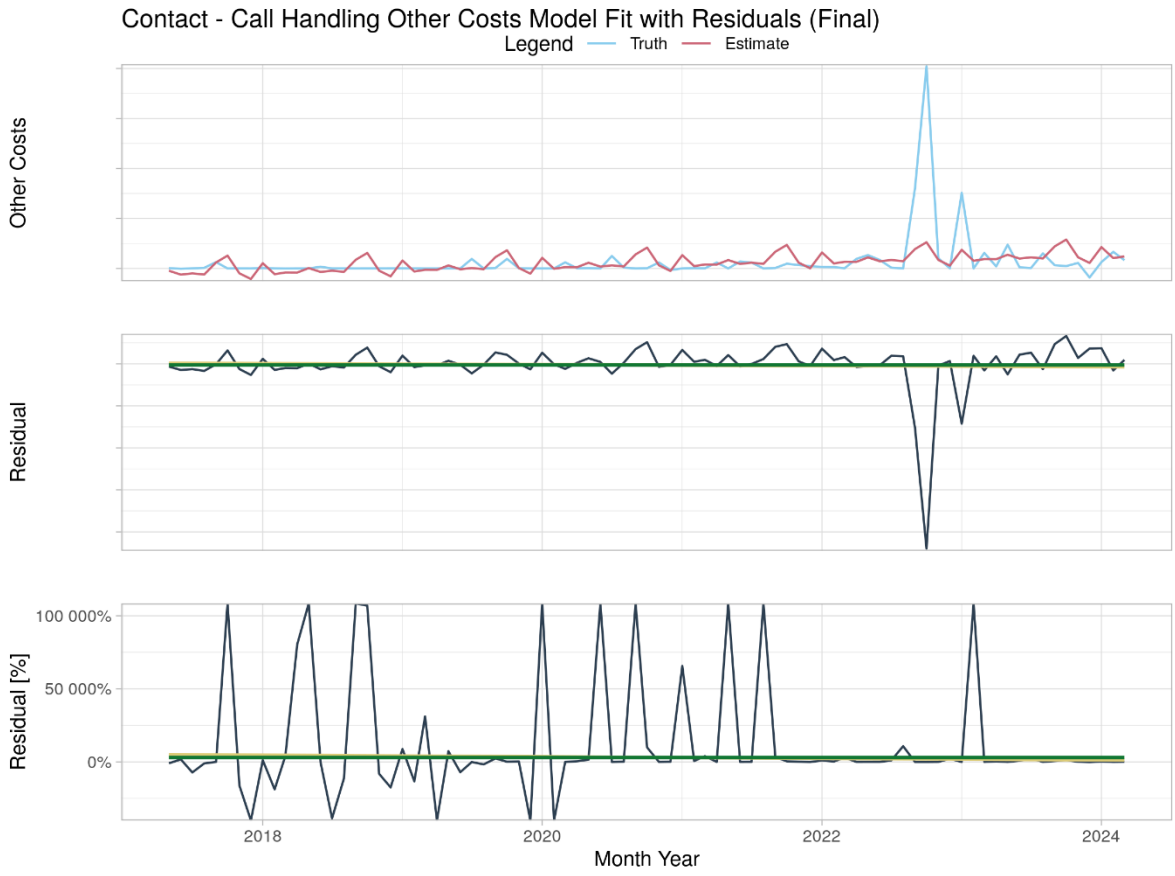
As with all models, fits will be recalculated periodically to address model drift and account for any changes in the data generation processes. Additional adjustments may be necessary when teams are moved between departments and finance data markers are updated or changed. Furthermore, as internal performance metrics evolve or new ones are introduced, this system will be updated to ensure alignment.

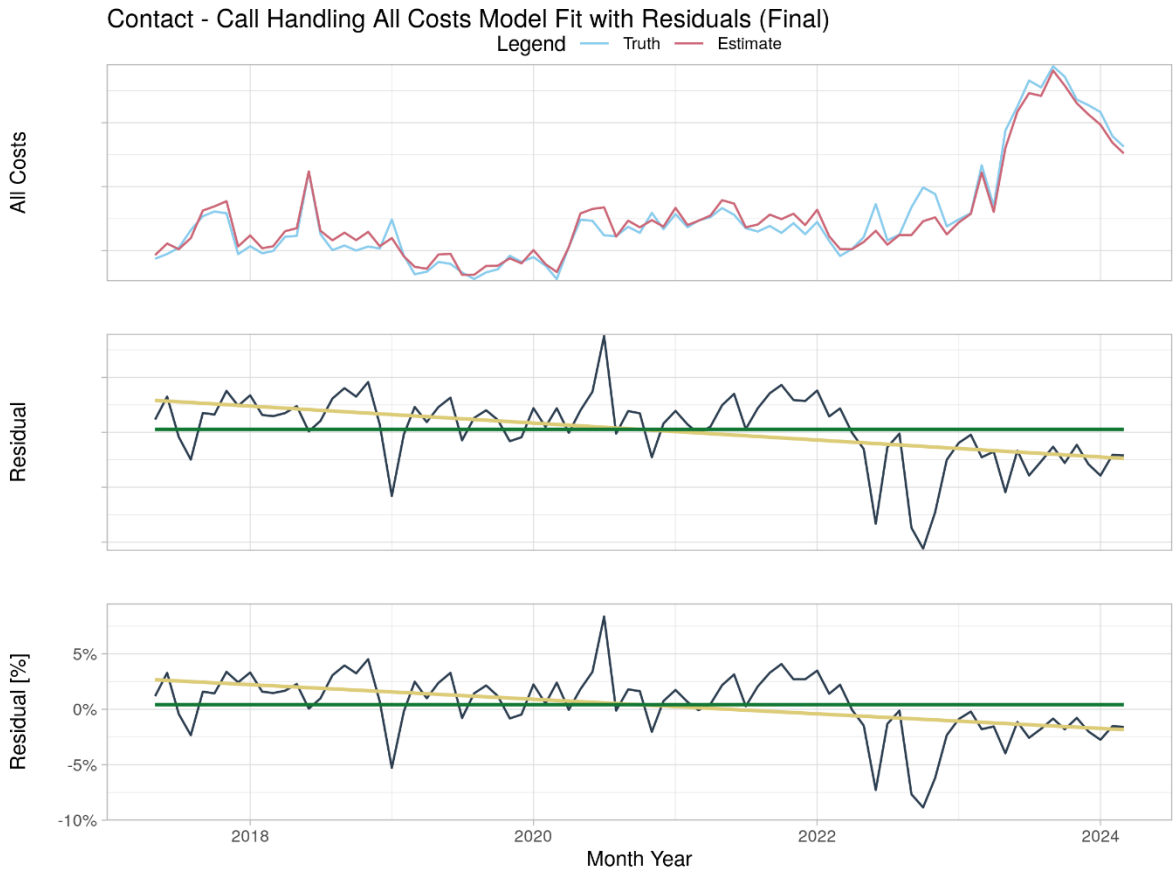
Appendix A: Force Contact (monthly)

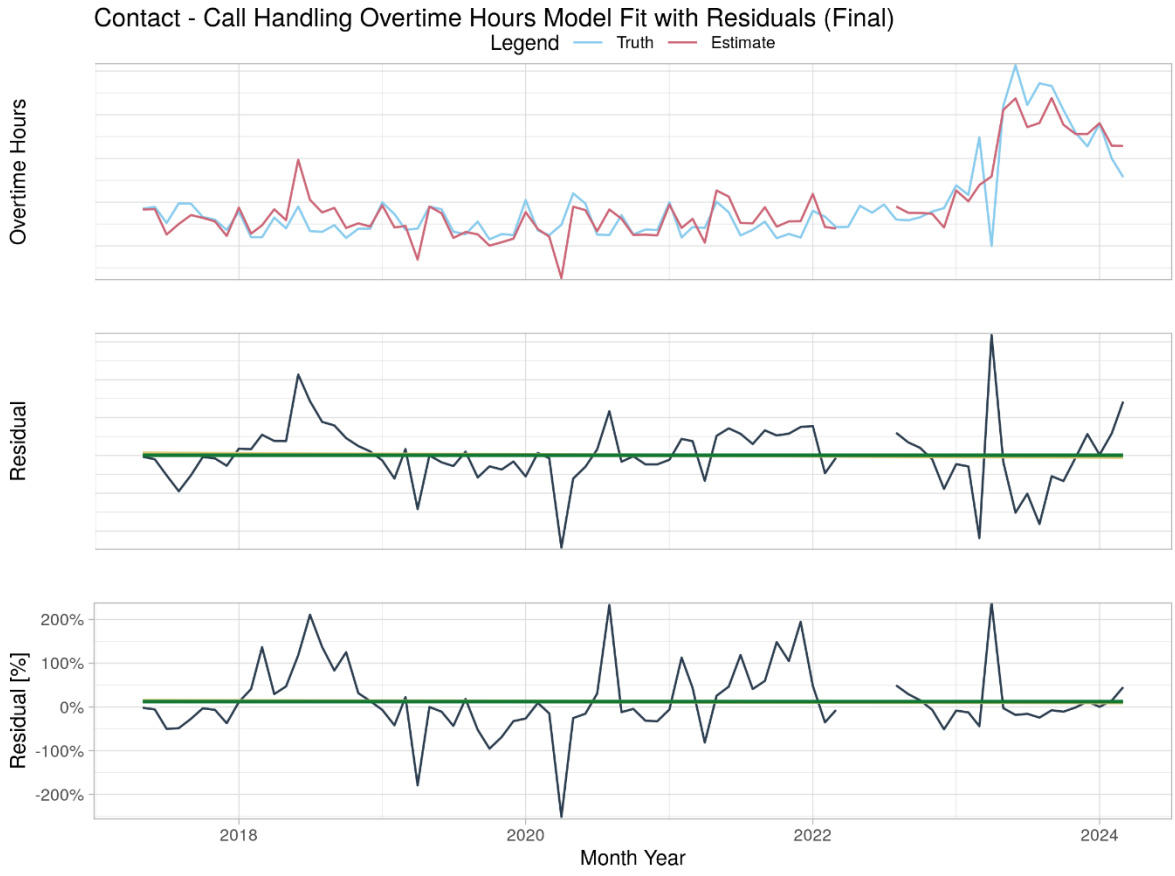


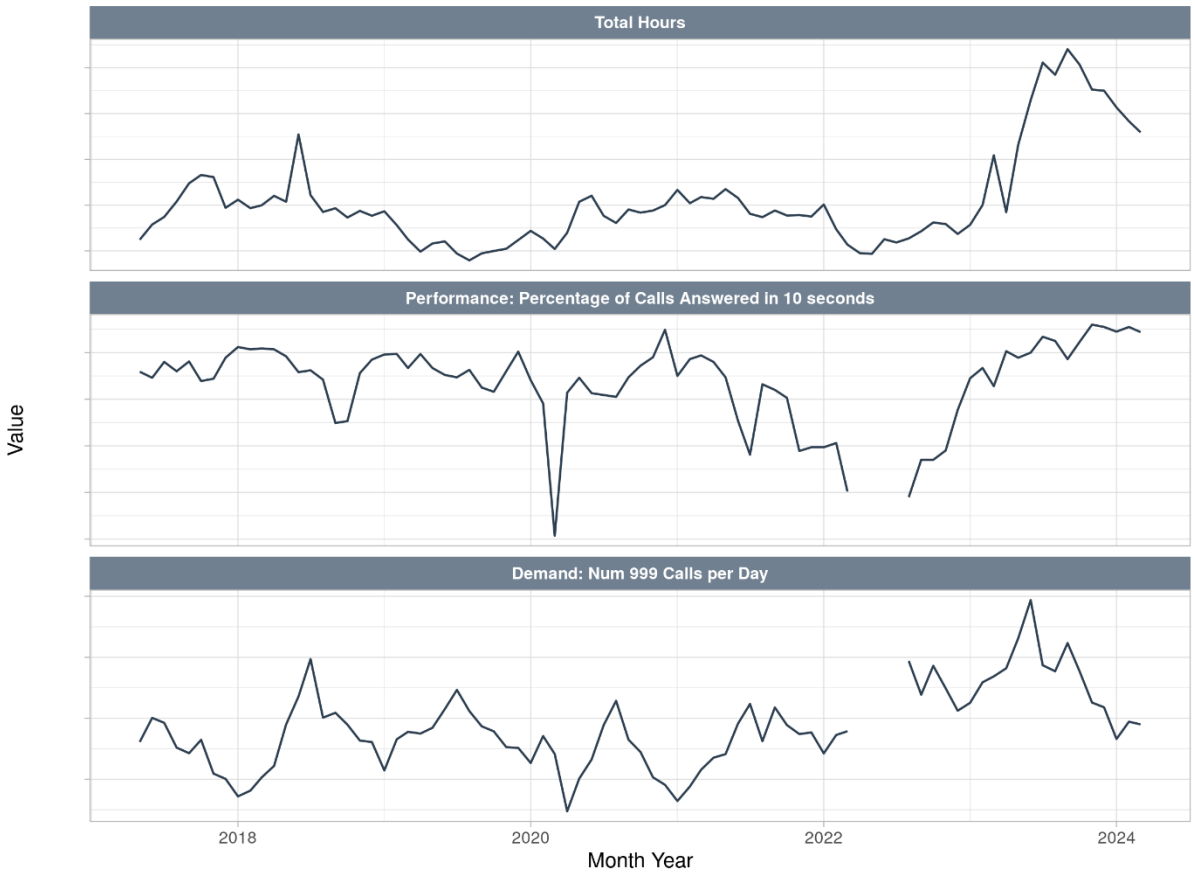

Contact - Call Handling Overtime Pay Model Fit with Residuals (Final)
Legend
Truth
Estimate
Overtime Pay
Residual
Residual [%]
40%
20%
0%
2018
2020
2022
2024
Month Year

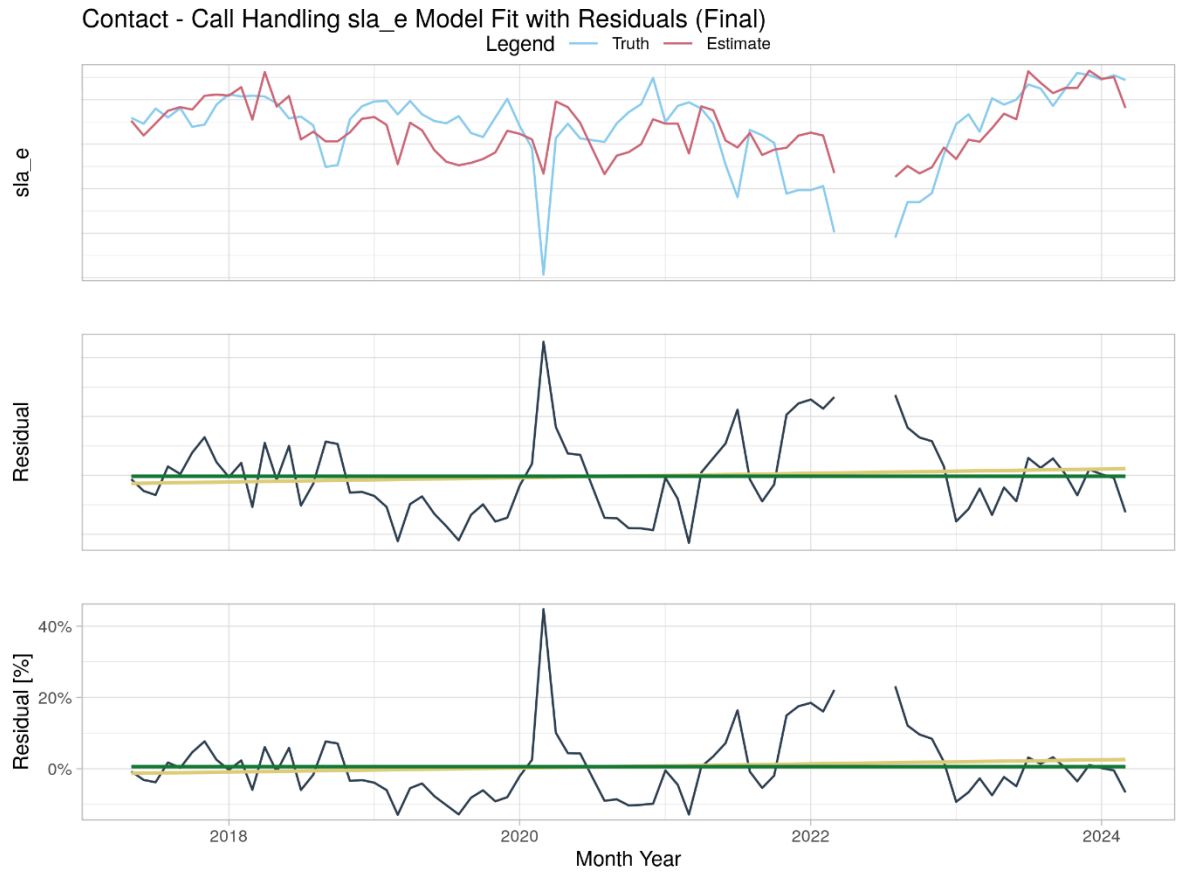

Contact - Call Handling Other People Costs (Combined) Model Fit with Residuals (Final)
Legend
Truth
Estimate
ther People Costs (Combined)
Residual
Residual [%]
10%
0%
-10%
2018
2020
2022
2024
Month Year

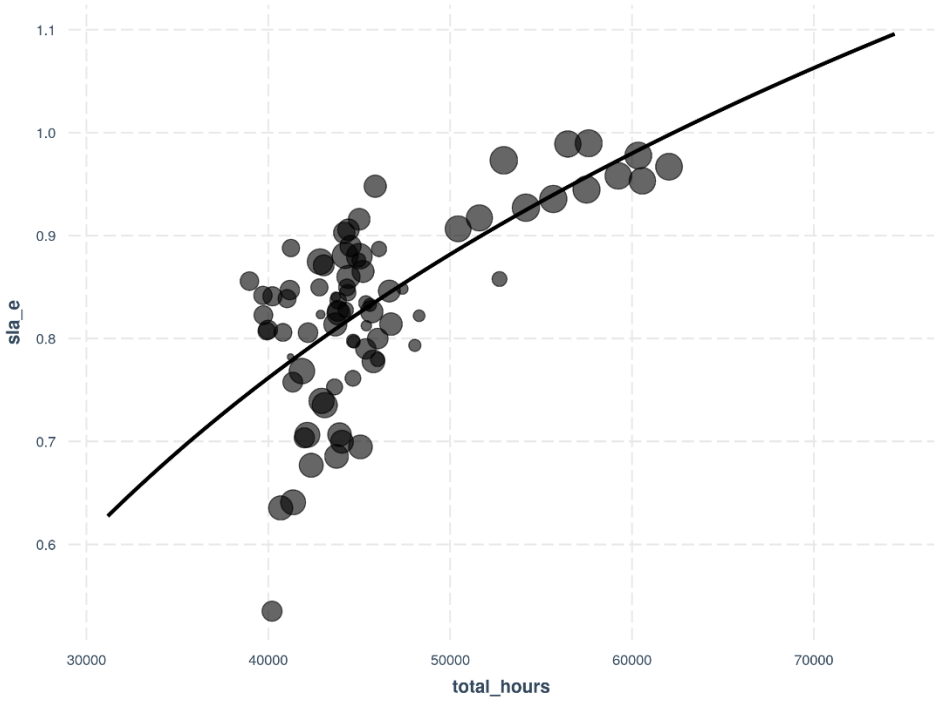

Contact - Call Handling Other Costs Model Fit with Residuals (Final)
Legend
Truth
Estimate
Other Costs
Residual
Residual [%]
100 000%
50 000%
0%
2018
2020
2022
2024
Month Year

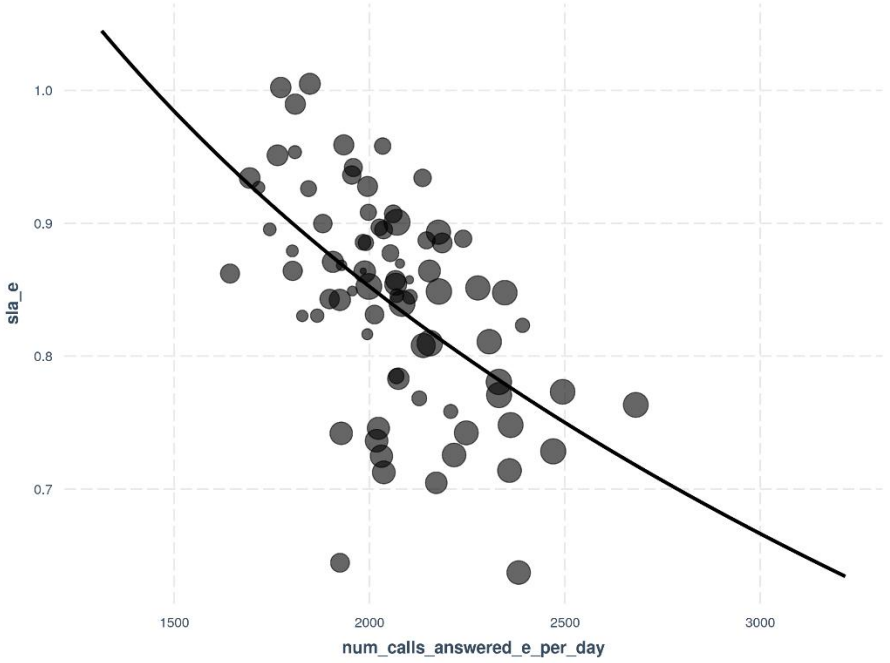

Contact - Call Handling All Costs Model Fit with Residuals (Final)
Legend
Truth
Estimate
All Costs
Residual
Residual [%]
5%
0%
-5%
-10%
2018
2020
2022
2024
Month Year


Contact - Call Handling Overtime Hours Model Fit with Residuals (Final)
Legend
Truth
Estimate
Overtime Hours
Residual
Residual [%]
200%
100%
0%
-100%
-200%
2018
2020
2022
2024
Month Year

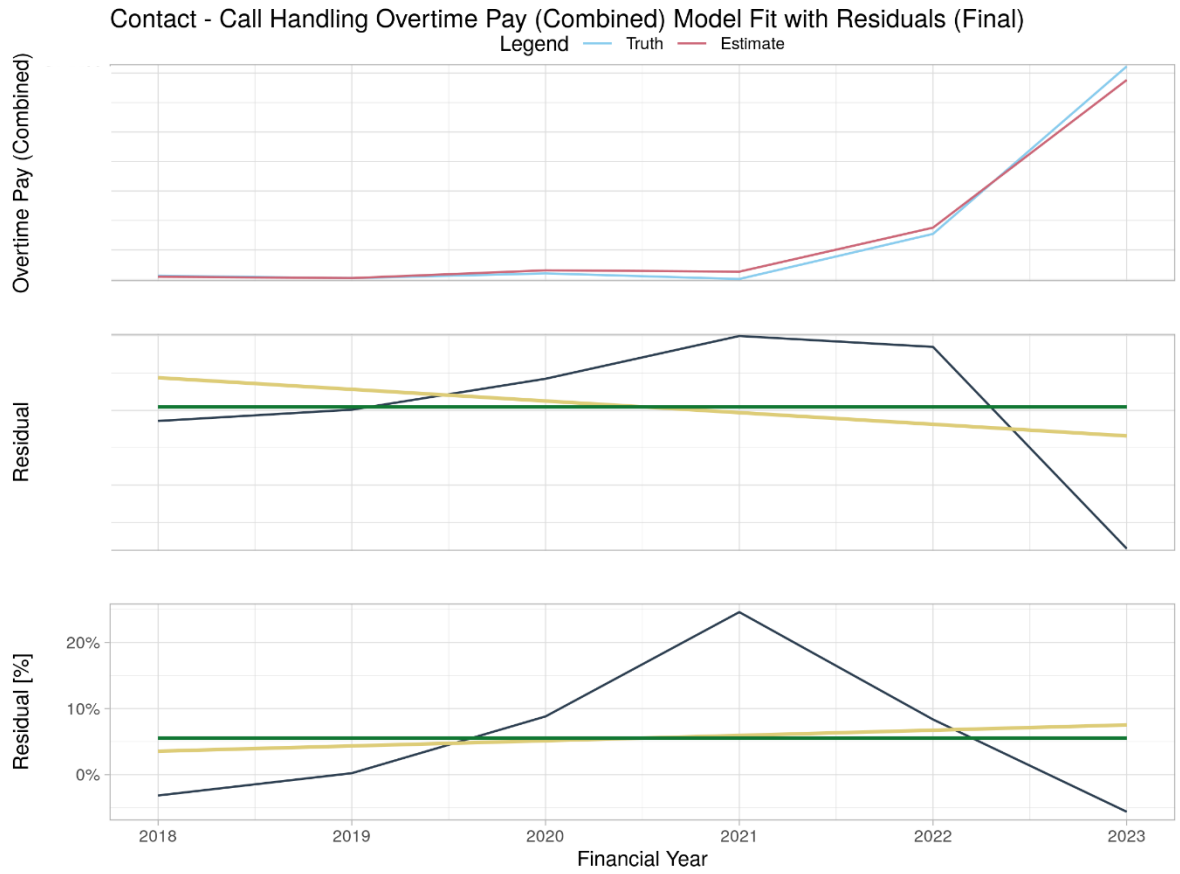

Total Hours
Performance: Percentage of Calls Answered in 10 seconds
Demand: Num 999 Calls per Day
Value
2018
2020
2022
2024
Month Year

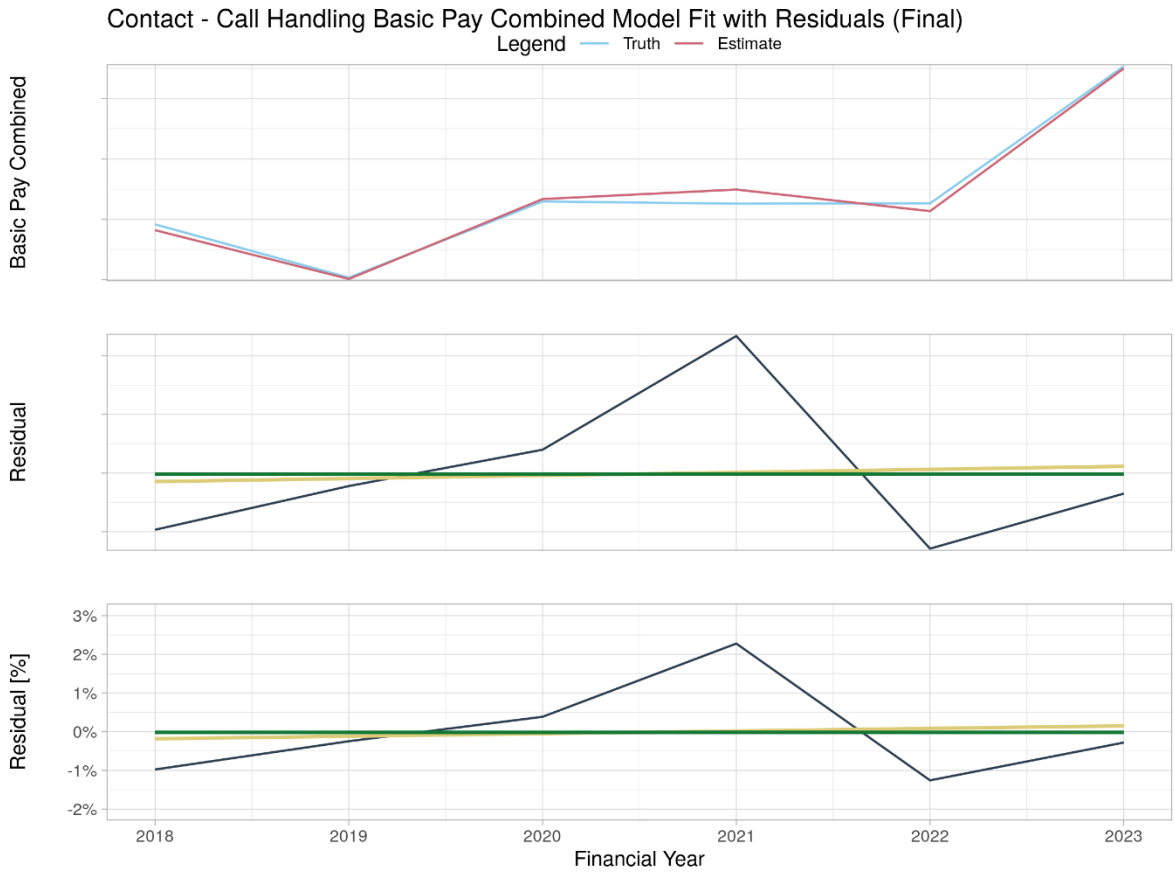

Contact - Call Handling sla_e Model Fit with Residuals (Final)
Legend
Truth
Estimate
sla_e
Residual
Residual [%]
40%
20%
0%
2018
2020
2022
2024
Month Year

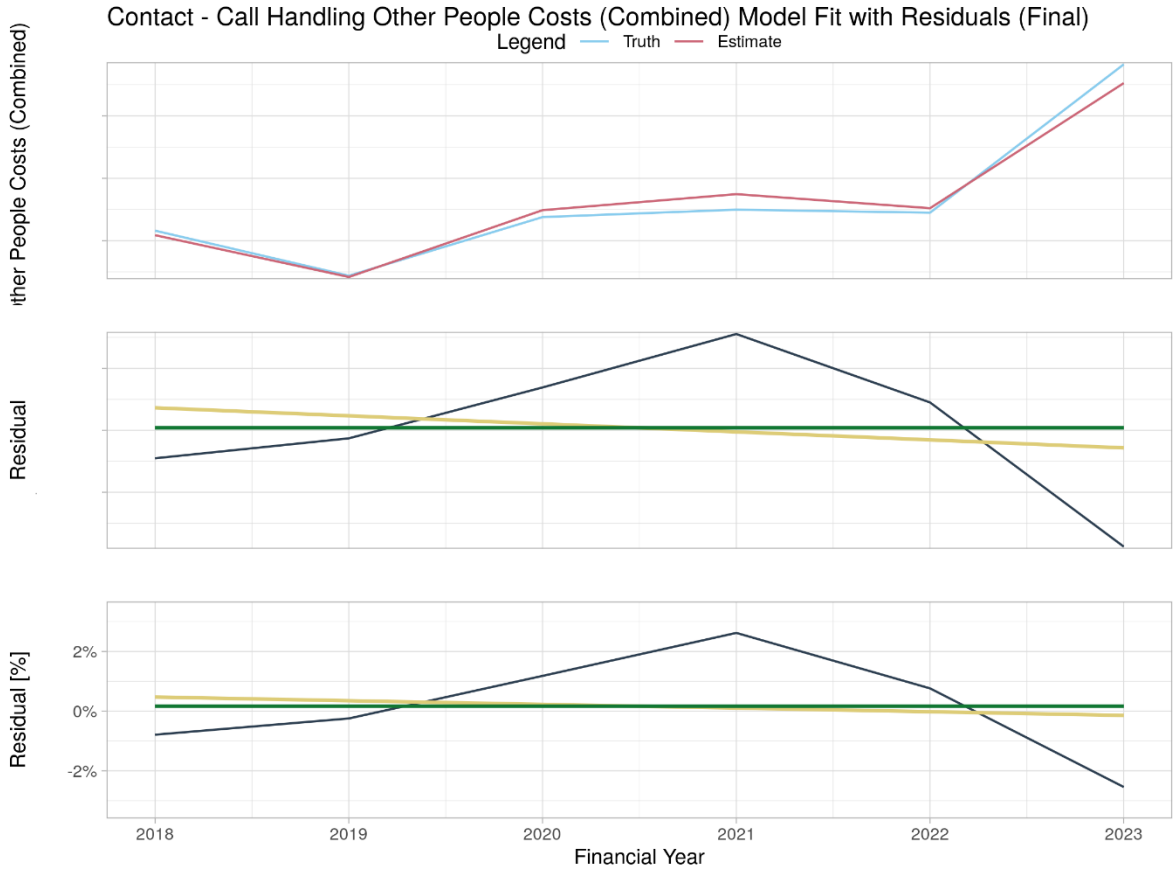

1.1
1.0
0.9
0.8
0.7
0.6
sla_e
30000
40000
50000
60000
70000
total_hours

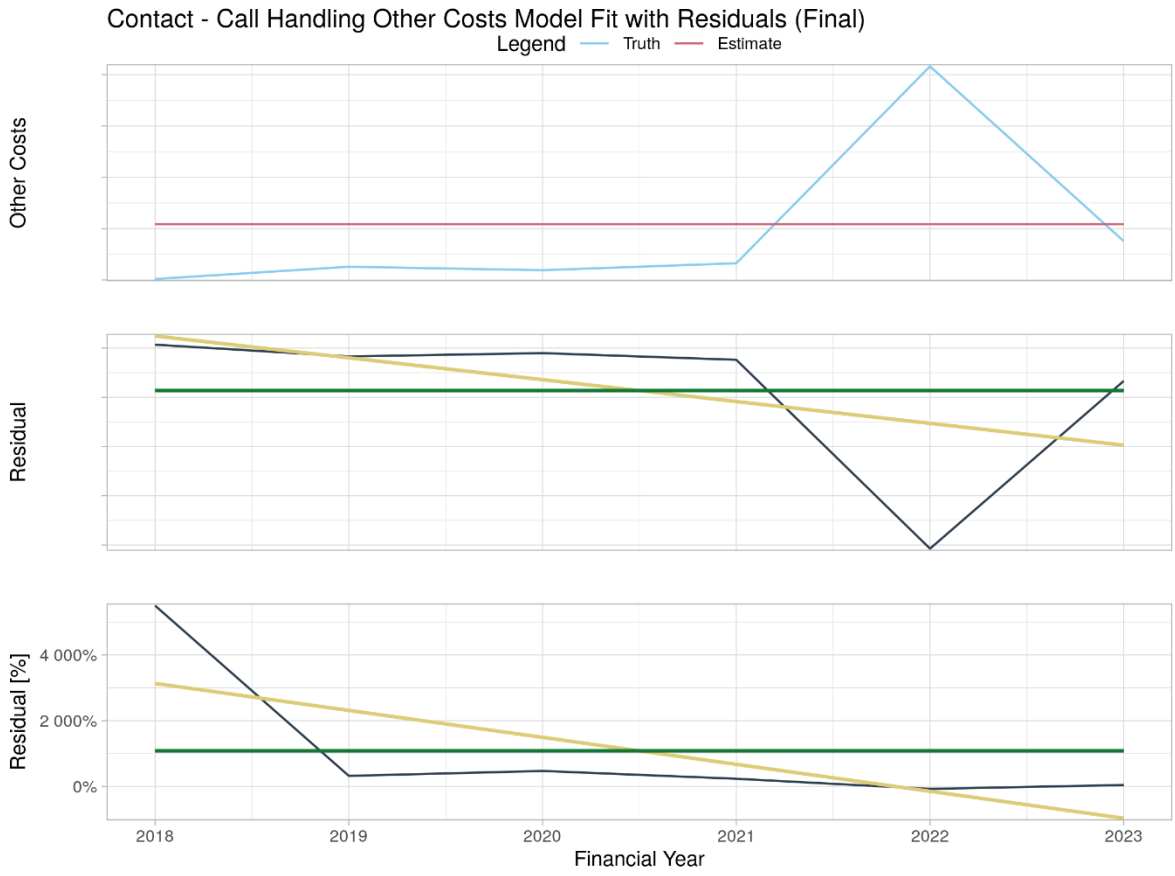

1.0
0.9
0.8
0.7
sla_e
1500
2000
2500
3000
num_calls_answered_e_per_day

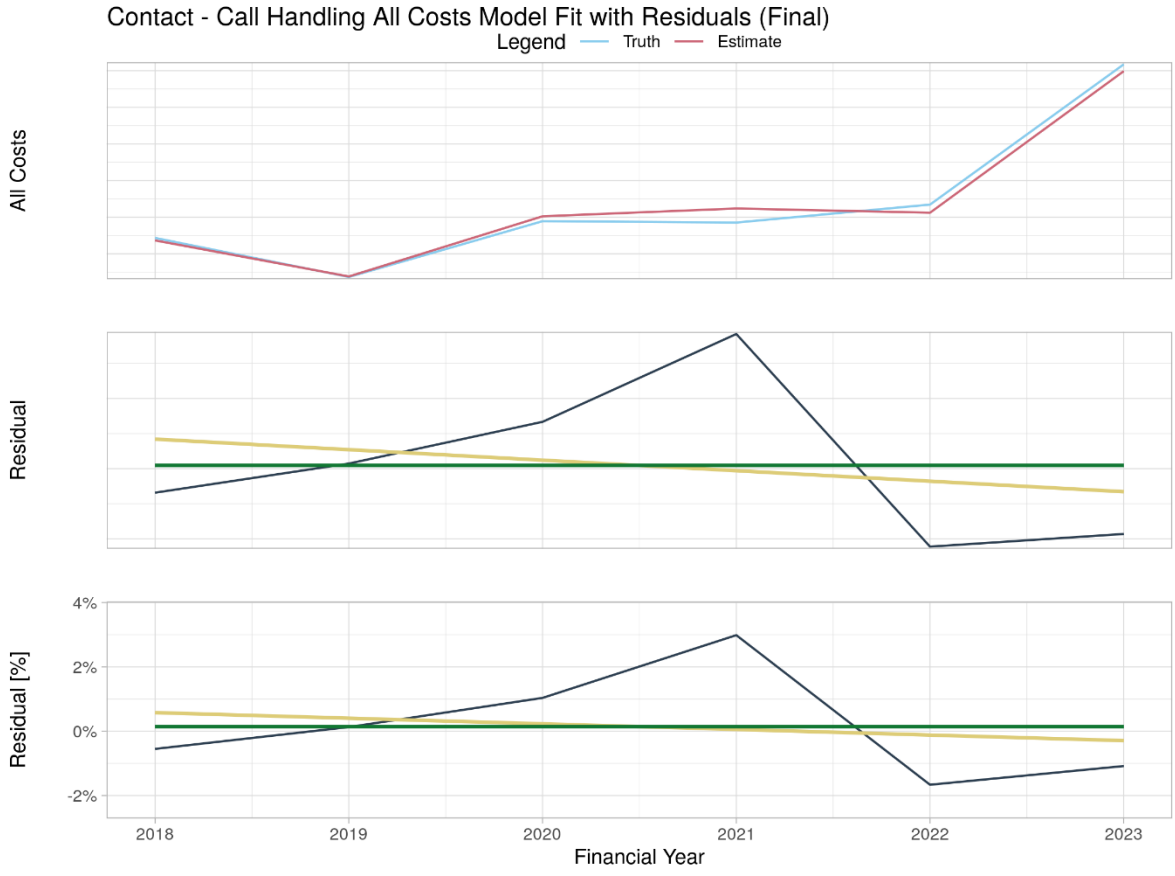
Appendix B: Force Contact (FY)

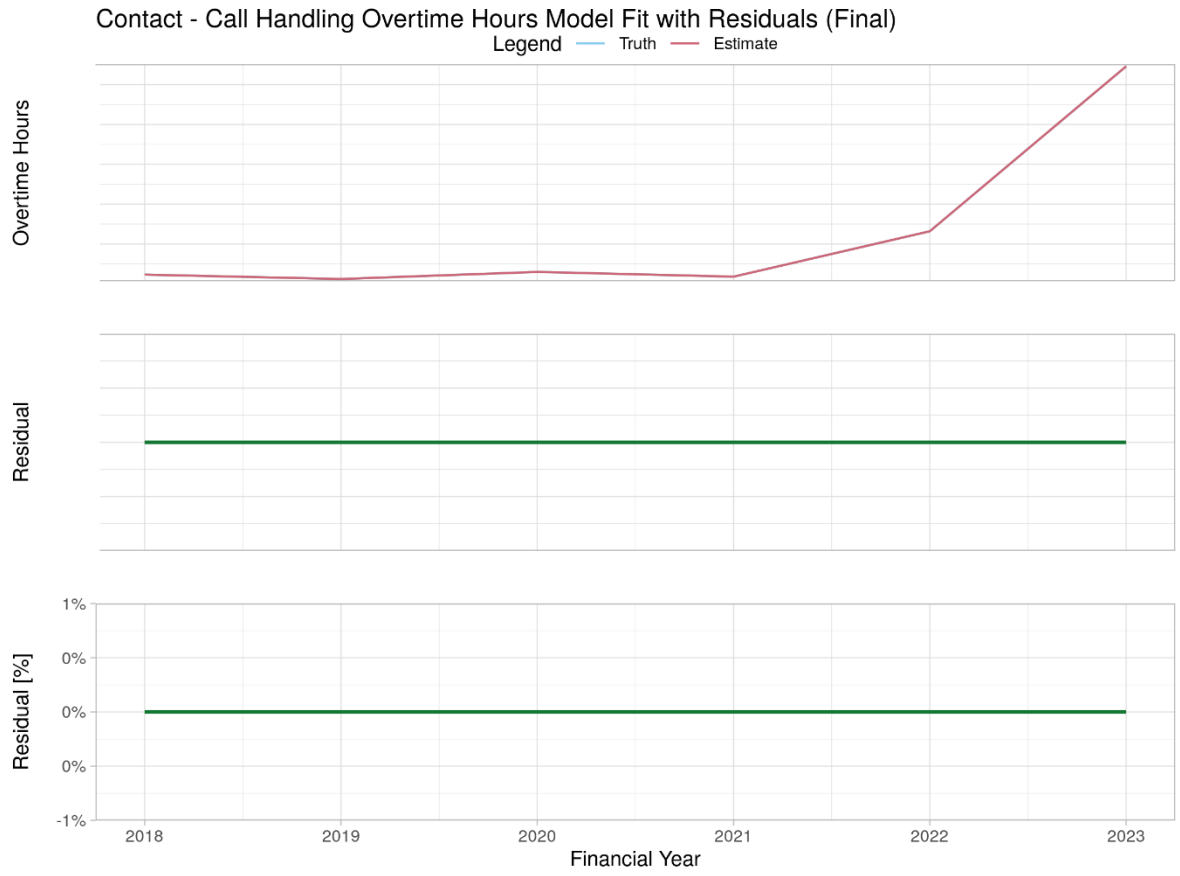


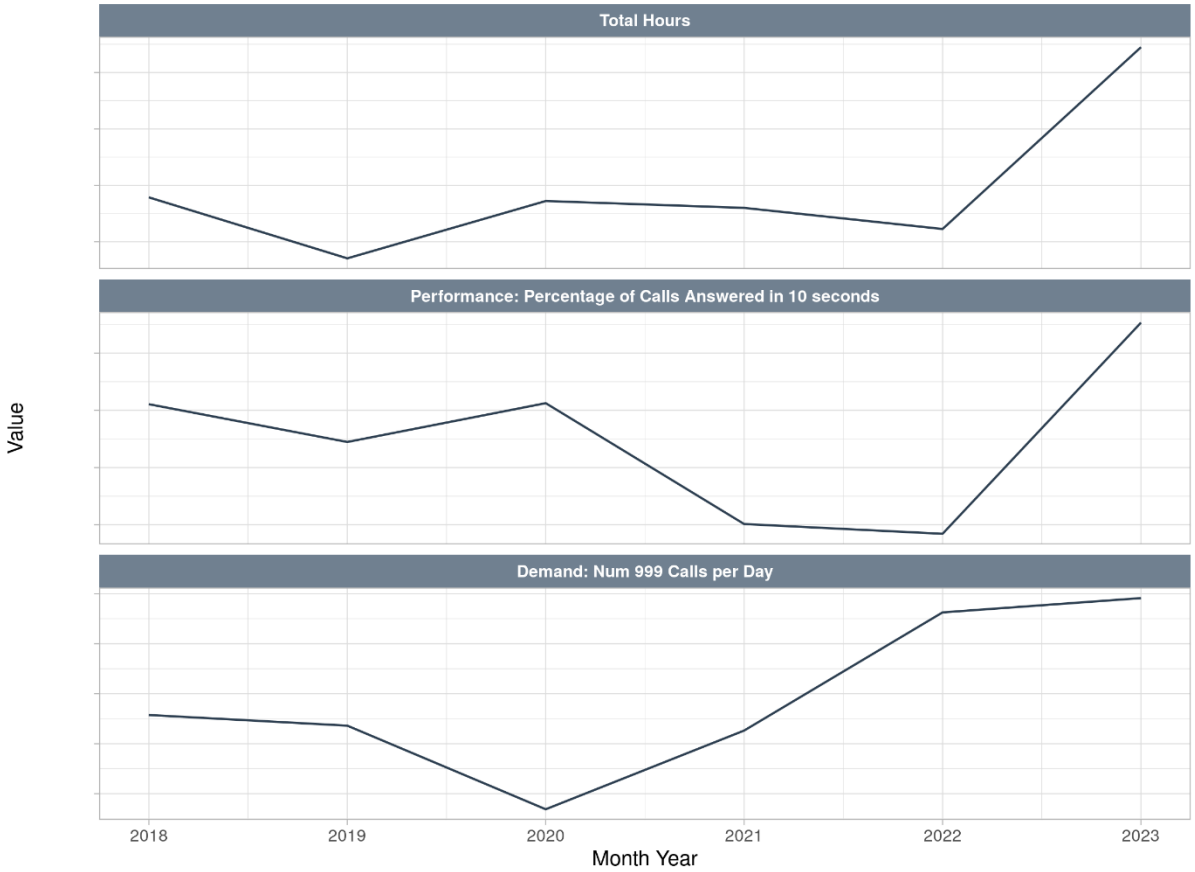

Contact - Call Handling Basic Pay Combined Model Fit with Residuals (Final)
Legend
Truth
Estimate
Basic Pay Combined
Residual
Residual [%]
3%
2%
1%
0%
-1%
-2%
2018
2019
2020
2021
2022
2023
Financial Year

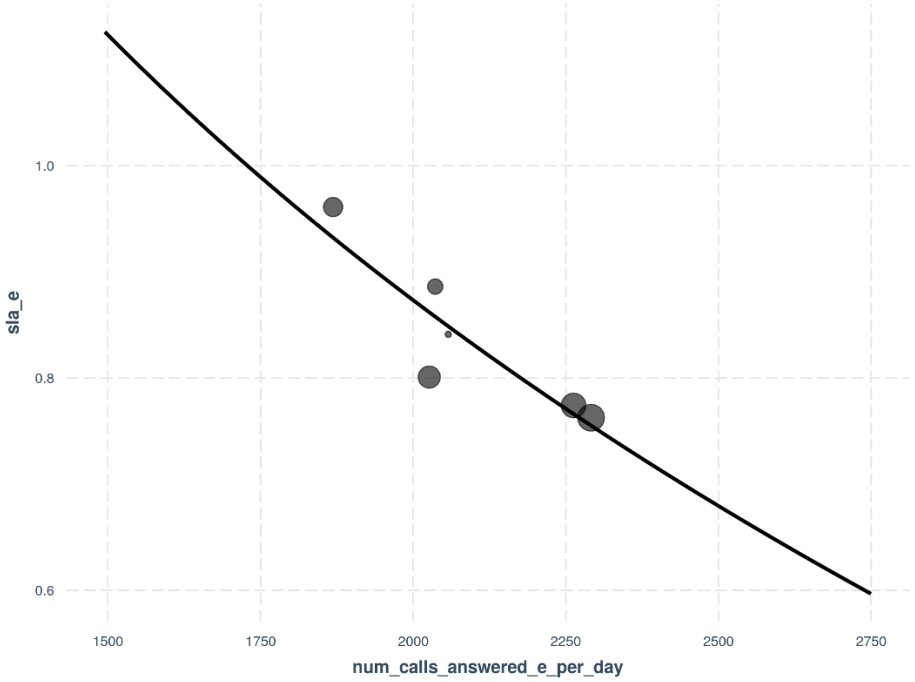

Contact - Call Handling Other People Costs (Combined) Model Fit with Residuals (Final)
Legend
Truth
Estimate
ther People Costs (Combined)
Residual
Residual [%]
2%
0%
-2%
2018
2019
2020
2021
2022
2023
Financial Year

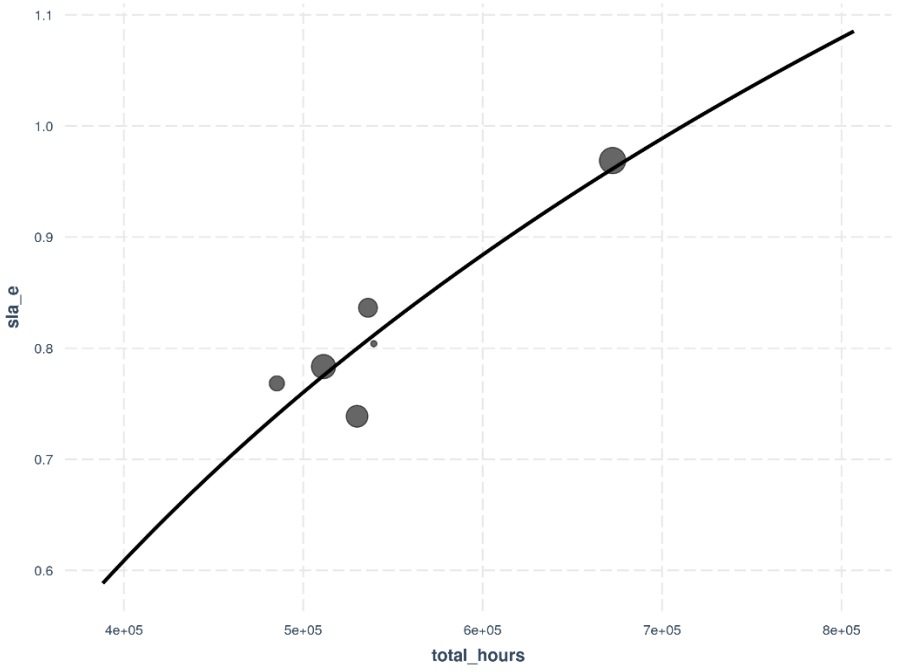

Contact - Call Handling Other Costs Model Fit with Residuals (Final)
Legend
Truth
Estimate
Other Costs
Residual
Residual [%]
4 000%
2 000%
0%
2018
2019
2020
2021
2022
2023
Financial Year


Contact - Call Handling All Costs Model Fit with Residuals (Final)
Legend
Truth
Estimate
All Costs
Residual
Residual [%]
4%
2%
0%
-2%
2018
2019
2020
2021
2022
2023
Financial Year


Contact - Call Handling Overtime Hours Model Fit with Residuals (Final)
Legend
Truth
Estimate
Overtime Hours
Residual
Residual [%]
1%
0%
0%
0%
-1%
2018
2019
2020
2021
2022
2023
Financial Year


Total Hours
Performance: Percentage of Calls Answered in 10 seconds
Demand: Num 999 Calls per Day
Value
2018
2019
2020
2021
2022
2023
Month Year


1.0
0.8
0.6
sla_e
1500
1750
2000
2250
2500
2750
num_calls_answered_e_per_day


1.1
1.0
0.9
0.8
0.7
0.6
sla_e
4e+05
5e+05
6e+05
7e+05
8e+05
total_hours

Glossary:

BH	Bank Holidays
CAPEX	capital costs
CPI	Consumer Price Index
FTE	Full Time Equivalent
FY	Financial Year
NI	National Insurance
OPEX	operational costs
PCC	Police and Crime Commissioner
SME	Subject Matter Expert
WMP	West Midlands Police