



Department
for Education

Teacher supply model: a technical description

December 2013

Contents

Section 1: An introduction to the model	4
1.1 Purpose of the Model	4
1.2 Teachers included in the Model	4
1.3 Overview of the model	4
Section 2: Estimating the future supply of teachers	6
2.1 Supply - Simulating flows into and out of state-funded teaching:	6
2.2 Supply - new entrants to state-funded teaching	7
2.2.1 The number of ITT students	8
2.2.2 Number of students completing ITT in each year	9
2.2.3 Potential number of entrants to state-funded teaching	10
2.3 Supply: Teachers outside of state-funded teaching seeking to re-enter	11
2.4 Supply: Teachers leaving state-funded teaching	12
2.5 Supply: Retirements	14
Section 3: Estimating the future demand for state-funded teachers	16
Section 4: Using the model to determine the required number of ITT places	19
4.1 Comparing supply and demand	19
4.2 Calculating the optimum number of ITT places	19
4.3 Ensuring the robustness of the TSM	20
Section 5: Data sources of the TSM	21
Section 6: Glossary of terms	22
Annex 7.1 Teacher Supply Model estimates and details of 2014/15 allocations	23

Figures

Figure 1: A high-level view of the Teacher Supply Model	5
Figure 2: Estimating the future supply of teachers	6
Figure 3: Flows in to and out of teaching	7
Figure 4: The rate of teachers leaving state-funded teaching (wastage)	13
Figure 5: Age breakdown of qualified regular teachers in state-funded schools	14
Figure 6: Early Retirement Rates	15
Figure 7: Estimating the future demand for teachers	16
Figure 8: Number of pupils in state-funded schools in England	17

Tables

Table 1: Proportion of Primary trainees following different routes	8
Table 2: Average length of ITT course by provider type	9
Table 3: Average ITT completion rates by provider type	10
Table 4: Average entry rates from ITT by provider type	11
Table 5: Estimates from the Teacher Supply Model for the academic year 2014/15	24
Table 6: Estimates of the number of ITT places required	24

Section 1: An introduction to the model

This document describes the Teacher Supply Model (TSM) methodology as of November 2013, and has been published in response to the Education Select Committee's request to the Department for Education on the 11th of September 2013. All figures quoted in this document refer to the version of the TSM used for 2014/15 Initial Teacher Training (ITT) allocations as an illustrative example. The model is continuously updated as new data becomes available. Further information about the TSM will be published next year in advance of 2015/16 ITT allocations.

1.1 Purpose of the Model

The Department for Education uses the TSM to calculate the optimum number of ITT places required to match the future supply of teachers to the estimated demand for qualified teachers within the state funded sector in England. This information is used by the National College of Teaching and Leadership (NCTL) when allocating ITT places to training providers.

1.2 Teachers included in the Model

Since the focus of the TSM is to provide qualified teachers to state-funded schools, when considering the supply of teachers our definition includes regular qualified teachers¹ in England in state-funded, mainstream nursery, primary or secondary schools including academies and Free Schools².

1.3 Overview of the model

Figure 1 provides a high-level view of the Teacher Supply Model.

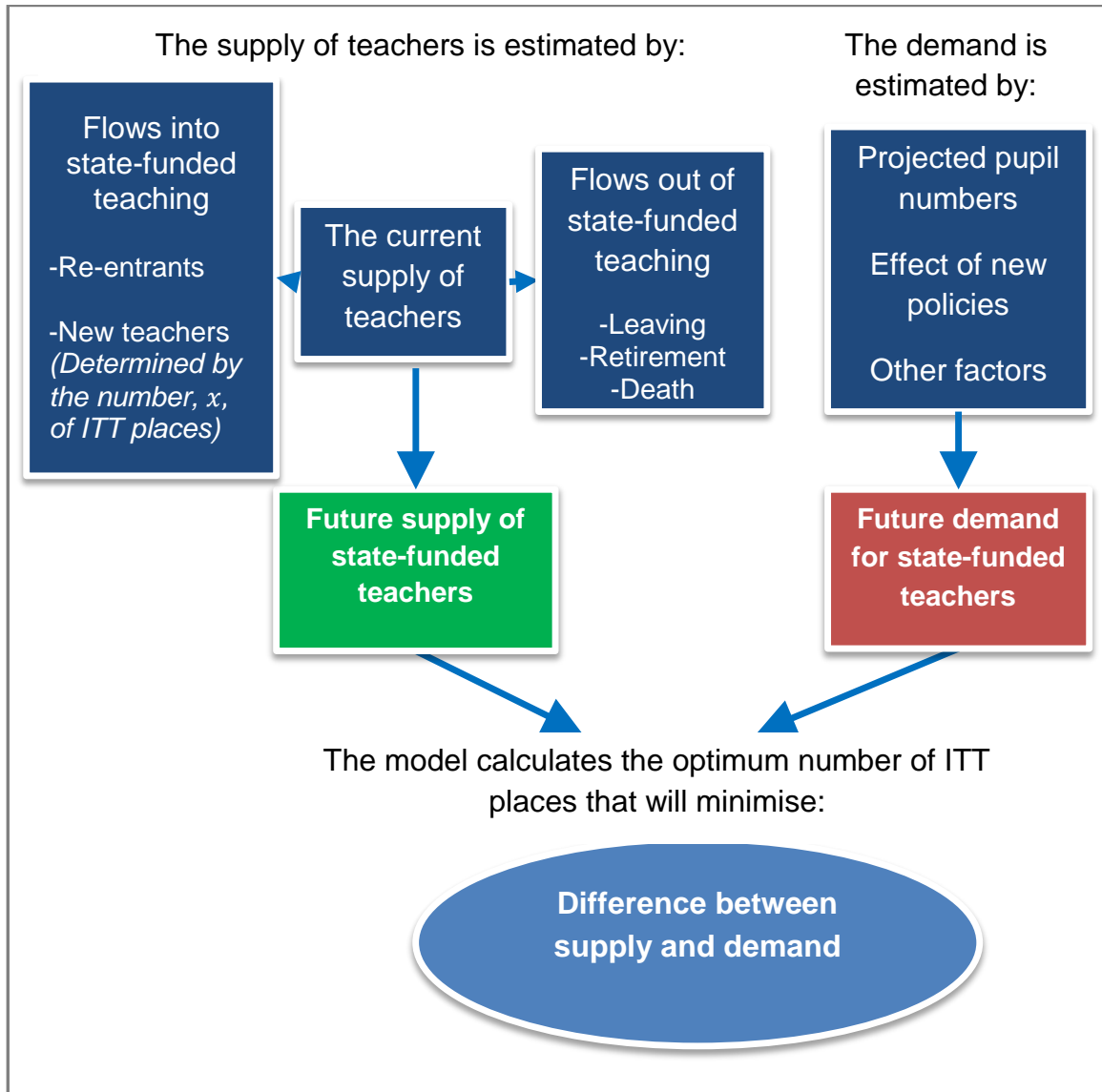
The number of ITT places allocated nationally (represented in the model by x) feeds into the modelling of the future supply of teachers. The purpose of the model is to calculate the optimum value of ITT places, x , that minimises the difference between supply and demand and provides at least as many teachers as the state-funded sector will require. The output from the most recent round of the TSM is included in Annex 7.1.

¹ For teacher supply, no differentiation is made between full-time and part-time because one ITT place is required to train each teacher. Teacher demand is calculated according to full-time equivalents (FTE), but is then converted to a headcount basis.

² Since September 2012, teachers in new academies and Free Schools no longer require Qualified Teacher Status (QTS). However over 96% of teachers in academies were qualified in November 2012. [DfE school workforce census publication, November 2012](#)

The modelling in Figure 1 is performed for future years, with the closing supply of state-funded teachers from every year forming the opening supply of teachers for the next year. Estimates for the future are based closely on data from recent years, with some adjustments made for known policy changes in particular subjects.

Figure 1: A high-level view of the Teacher Supply Model

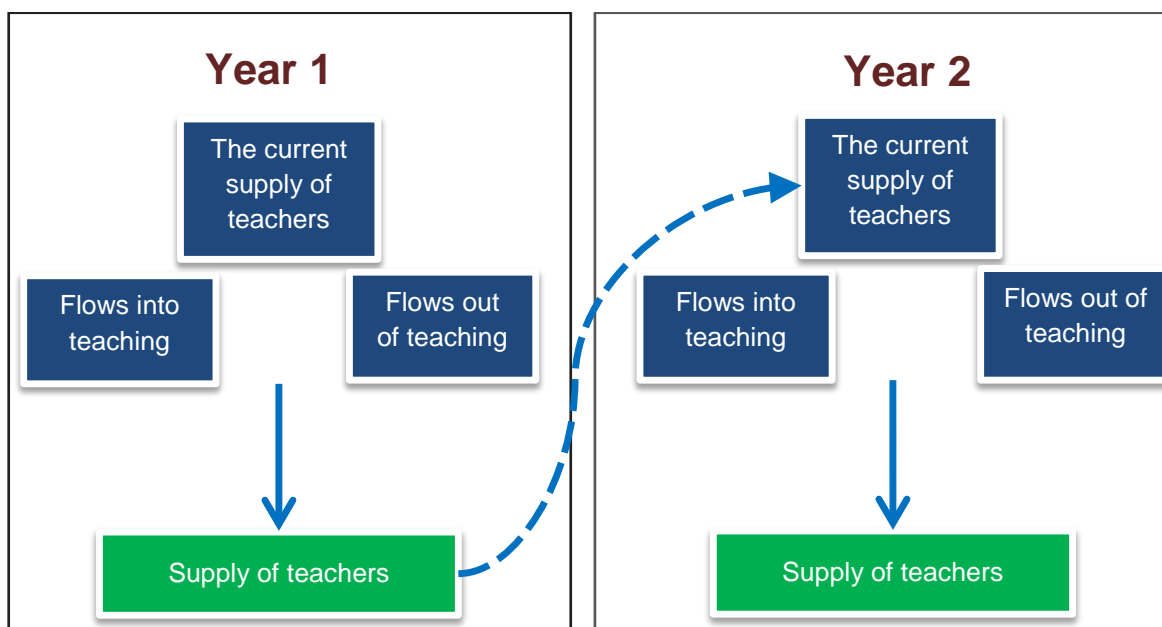


Section two outlines the supply modelling in detail, while section three explores teacher demand. Finally, in section four we discuss how supply and demand in the state-funded sector are compared to determine the optimum number of ITT places.

Section 2: Estimating the future supply of teachers

Figure 2 illustrates how supply is estimated. The current supply of state-funded teachers acts as a starting point and then flows into and out of state-funded teaching are simulated. The closing supply of state-funded teachers in each year then forms the opening supply for the next year.

Figure 2: Estimating the future supply of teachers



2.1 Supply - Simulating flows into and out of state-funded teaching:

The **flows in to state-funded teaching** are:

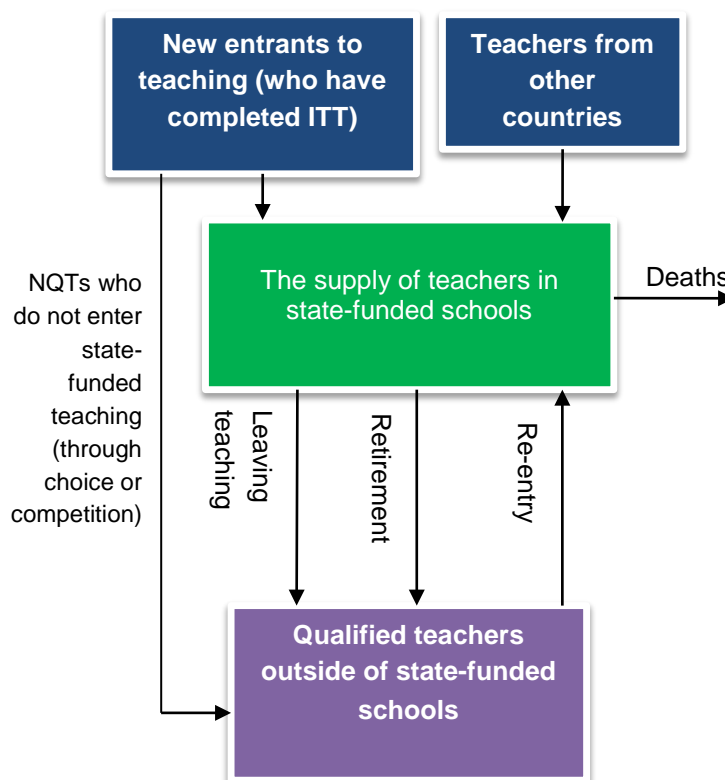
- New teachers who have completed their ITT training (section 2.2)
- Teachers outside of the state-funded sector seeking to re-enter (section 2.3)
- New teachers arriving from other countries (section 2.3)

The **flows out of state-funded teaching** are:

- Current teachers leaving the state sector (section 2.4)
- Retirement (section 2.5)
- Death (section 2.5)

These flows are illustrated in Figure 3.

Figure 3: Flows in to and out of teaching



Each flow shown in Figure 3 is simulated using information about the total number of teachers in state-funded schools and the total number of qualified teachers outside of the state-funded sector (including those not working as teachers or teaching in other sectors). This data is obtained from the database of Teacher Records (DTR) and the School Workforce Census³ broken down by age, gender and retirement age⁴. Analysis of age and gender-specific historical data is used to estimate the rates of flows between these groups as described in the following sections.

2.2 Supply - new entrants to state-funded teaching

The number of new entrants to state-funded teaching each year is estimated from the number of ITT students completing their training in that year. Historical data is used to estimate the proportion of ITT completers who will go on to teach in state-funded schools. This process is described below.

³ See section 5.4 for description of the data sources. The school workforce census (SWFC) is a newer more detailed source of teacher data than the DTR. Once SWFC collection methods become embedded and the quality of the data is established it will replace the DTR as the data source for teacher flows.

⁴ As well as age and gender, data on the current number of teachers is broken down into those with a retirement age of 60 and those with a retirement age of 65.

2.2.1 The number of ITT students

The number of trainees entering postgraduate provider-led, undergraduate provider-led and employment-based ITT routes is derived from the ITT Trainee Number Census⁵ and NCTL performance profiles⁶ and is depicted in Table 1. For primary, the proportions have been set to follow trends in recent years. For secondary, a three year average has been used.

ITT is comprised of many available routes:

- Provider-led courses are those which are primarily run by a college or university.
- Employment-based courses are those where the training is primarily undertaken whilst in employment in a school and comprise several well-publicised routes of ITT including School Direct.

The model is adjusted for new routes as they are introduced, most recently for School Direct.

Table 1: Proportion of trainees following different routes

Estimated rates for year 2012/13*

Route	Proportion of Primary trainees on route
Postgraduate provider-led	53%
Undergraduate provider-led	33%
Employment-based routes	14%
Total	100%

Route	Proportion of Secondary trainees on route
Postgraduate provider-led	76%
Undergraduate provider-led	5%
Employment-based routes	19%
Total	100%

*These figures are currently being updated following publication of new ITT figures in November 2013.

⁵ [DfE publication on initial teacher training: Trainee Number Census](#) (See Section 5.3)

⁶ [NCTL performance profiles](#) (Section 5.2)

2.2.2 Number of students completing ITT in each year

We estimate how many of these students will complete ITT in each year, by considering:

- The length of the ITT course for each route and;
- The completion rate (the percentage of students that finish the course and achieve QTS). This is estimated from historical data and adjusted for future years by the estimated impact of any changes to the skills tests.

Estimates of provider-led course lengths are based on averages for recent years, derived from the Trainee Numbers Census⁷. The distributions of course lengths are shown in Table 2.

The ITT completion rates are derived from the Trainee Numbers Census (for provider-led routes) and the NCTL Performance Profiles⁸ (for employment-based routes) and are depicted in Table 3. Where the data displays a clear trend of increasing or decreasing completion rates then a two year average is shown. Where no trend is seen, a three year average is used.

Table 2: Average length of ITT course by provider type

Estimated rates for year 2012/13*

Primary trainees	1 year	2 years	3 years	4 years
Postgraduate provider-led	92%	6%	2%	0%
Undergraduate provider-led	1%	2%	59%	38%
Employment-based routes	94%	6%	0%	0%

Secondary trainees	1 year	2 years	3 years	4 years
Postgraduate provider-led	95%	4%	1%	0%
Undergraduate provider-led	0%	15%	60%	25%
Employment-based routes	94%	6%	0%	0%

*All estimates are based on a two or three year average of data from recent years. Two year averages are used where a clear trend is seen, otherwise three year averages are used. These figures are currently being updated following publication of new ITT figures in November 2013.

⁷ [DfE publication on initial teacher training: Trainee Number Census](#) (Section 5.3)

⁸ [NCTL performance profiles](#) (Section 5.2)

Table 3: Average ITT completion rates by provider type

Estimated rates for year 2012/13*

Route	Average completion rate for primary trainees
Postgraduate provider-led	97%
Undergraduate provider-led	80%
Employment-based routes	93%

*Estimated rates based on average of the two most recent years due to increasing completion rates.

Route	Average completion rate for secondary trainees
Postgraduate provider-led	96%
Undergraduate provider-led	79%
Employment-based routes	91%

*Estimated rates for physics, chemistry and computer science based on a two year average due to increasing completion rates between 2009 and 2010; other subjects use a three year average. These figures are currently being updated following publication of new ITT figures in November 2013.

Using the course lengths in Table 2 and the assumed ITT completion rates in Table 3, we can calculate the number of ITT students estimated to complete ITT in each year.

2.2.3 Potential number of entrants to state-funded teaching

The number of new entrants to state-funded teaching is estimated using the rate of ITT completers in recent years taking up positions in state-funded schools (i) within the same year or (ii) after one or two years. These rates are calculated from recent data in the NCTL Performance Profiles and Employment Dataset and the proportions used to inform 2014/15 allocations are shown in Table 4. It should be noted that ITT completers who do not go into state-funded teaching within two years are recorded as inactive teachers (who may enter state-funded teaching in future years – see section 2.3).

Table 4: Average entry rates from ITT by provider type
 Estimated base rates for year 2013/14*

Route	Proportion seeking to enter state-funded teaching	Primary entry rate
Provider-led	Within same year	70%
Provider-led	After 1 or 2 year break	11%
Employment-based routes	Within same year	96%
Employment-based routes	After 1 or 2 year break	2%

*Estimated rates based on average of three most recent years.

Route	Proportion seeking to enter state-funded teaching	Secondary entry rate
Provider-led	Within same year	69%
Provider-led	After 1 or 2 year break	11%
Employment-based routes	Within same year	96%
Employment-based routes	After 1 or 2 year break	2%

*Estimated rates based on most recent data to reflect emerging trends. These figures are currently being updated following publication of new ITT figures in November 2013.

2.3 Supply: Teachers outside of state-funded teaching seeking to re-enter

We calculate the number of teachers outside of the state-funded sector expected to re-enter by applying historical age, subject and gender specific re-entry rates to the number of qualified teachers outside of the state-funded sector. Re-entry rates are derived from the Database of Teacher Records (DTR)⁹ using an exponentially weighted average of the last four years' available data.

The re-entry numbers are adjusted upwards to account for those who attempt to re-enter but are unsuccessful. There are no available data on the success rate of teachers outside of the state-funded sector applying for posts, so their success rate is assumed to be the same as for teachers who have recently completed ITT, which is currently 93%. This figure represents the proportion of ITT completers who secure a teaching post within

⁹ See section 5.4

six months, and is derived from the Destination of Leavers from Higher Education (DLHE) survey, via the NCTL Performance Profiles¹⁰.

2.4 Supply: Teachers leaving state-funded teaching

The numbers of teachers who will leave state-funded teaching in each year (referred to hereafter as wastage), is also estimated using historical rates specific to age, gender, subject taught and phase of teaching based on data from the DTR.

The TSM also incorporates an econometric wastage model, which uses regression analysis applied to time-series data since the 1970s. This analysis allows us to model the relationship between the rate of teacher wastage in each year and the following factors:

- **The rate of teacher wastage in the previous year:**
Data: DTR data¹¹ on age-specific wastage (excluding retirement) is used from 1971 to 2010.
- **The GDP Growth Rate:**
Data: The YBEZ series for the years 1965 to 2011 published by the Office for National Statistics (ONS)¹². GDP forecasts up to 2016 are obtained from Table 1.1 of the *Economic and fiscal outlook December 2012*¹³ by the Office for Budget Responsibility (OBR).
- **Unemployment claimant rates:**
Data: The seasonally adjusted rate (BJCE) for the period 1970 to 2011 published by ONS. As with GDP, unemployment forecasts up to 2016 are obtained from Table 1.1 of the *Economic and fiscal outlook December 2012* by OBR.
- **Relative pay:** This is the ratio of the average pay of teachers to the average pay of non-manual employees. As there is no forecast of relative pay it is assumed to remain constant after 2011.
Teacher pay data: Gender-specific average pay of qualified teachers in England and Wales from 1973 to 2011 is taken from the DTR.
Non-manual pay data: The mean pay for men and women in England and Wales, for all occupations except (1) process, plant & machine operatives and (2) elementary occupations, from 1970 to 2011. This is taken from the Annual Survey of Hours and Earnings by ONS¹⁴.

¹⁰ [NCTL performance profiles](#) (Section 5.2)

¹¹ Database of Teacher Records (Section 5.4)

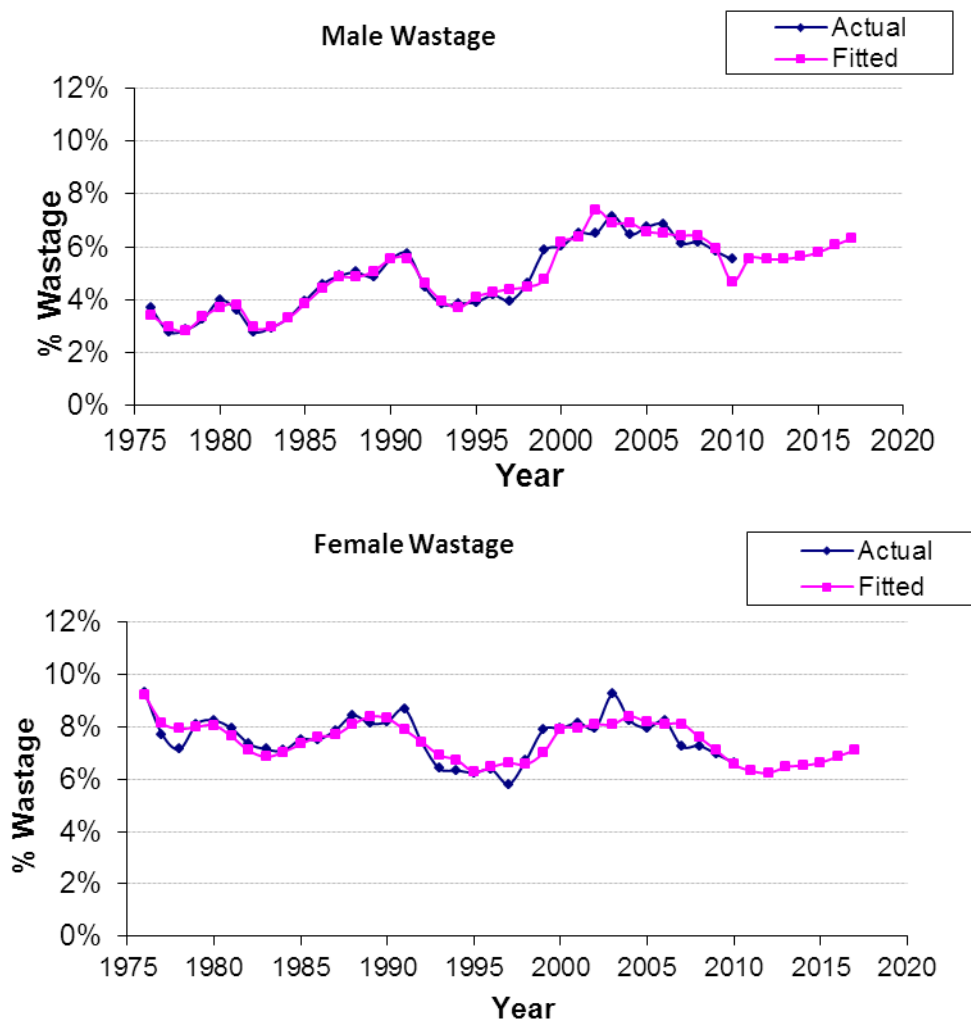
¹² [YBEZ series for GDP, ONS](#)

¹³ [Forecasts for GDP, OBR](#)

¹⁴ [Survey of Hours and Earnings, ONS](#)

Differing projections for unemployment and GDP (published in the Treasury's *Economic Forecast for the UK Economy: A comparison of independent forecasts*¹⁵) are fed into the model to explore the sensitivity of teacher supply to changes in the economy. The projections corresponding to the OBR's best estimates are then used to adjust the rate of teachers leaving state-funded teaching in each year by a scaling factor determined by the regression analysis. Figure 4 shows the results of the regression model compared to actual wastage data.

Figure 4: The rate of teachers leaving state-funded teaching (wastage)
1975 to 2011 (actual data), 2012-2020 (projected)

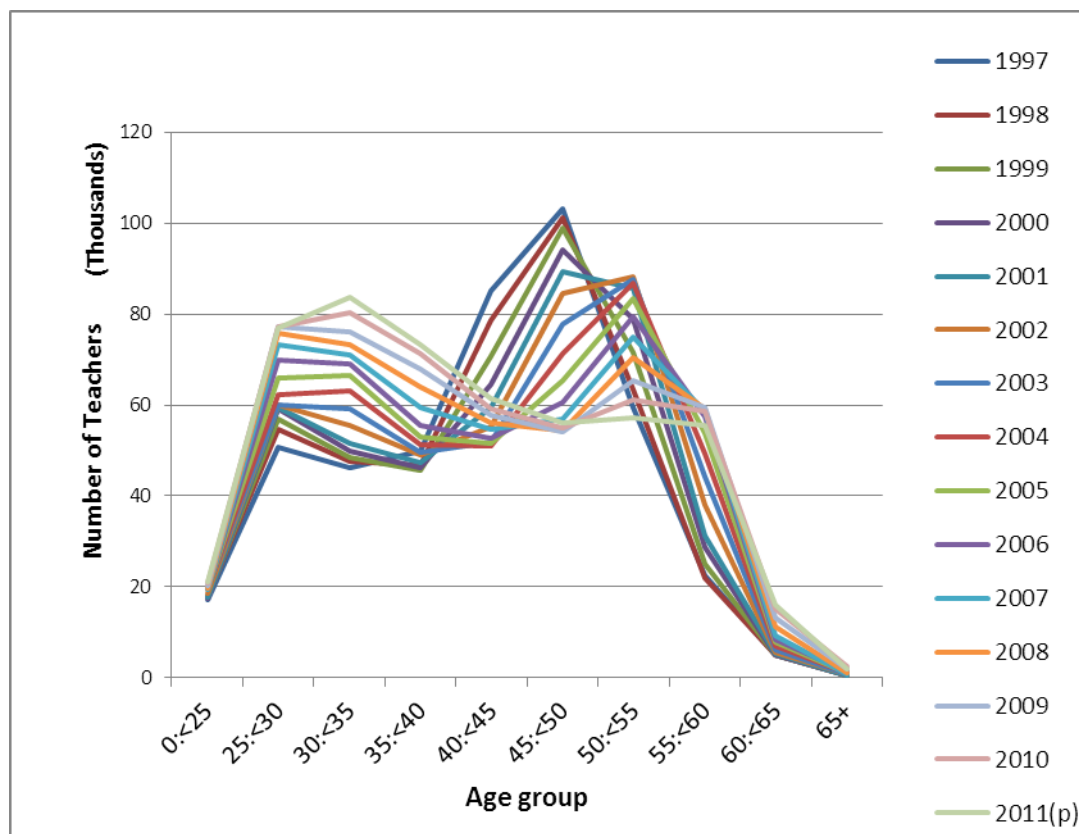


¹⁵ [Economic Forecasts for the UK Economy, Treasury](#)

2.5 Supply: Retirements

The number of retirements (and deaths) is estimated from the expected age profile of the teacher workforce in future years. Figure 5 shows how the age profile of state-funded teachers has changed since 1997. A clear pattern can be seen, with the peak corresponding to baby-boomers moving to steadily to the right as these teachers reach retirement age.

Figure 5: Age breakdown of qualified regular teachers in state-funded schools in England



Source: DTR (See section 5.4). Data for 2011 is provisional.

Teachers may choose to retire before their normal retirement age and take actuarially reduced benefits (a reduced pension); others chose to go part-time (referred to as phased retirement). Premature retirement is initiated by the employer. Since 2010, teachers aged 55 and over are eligible for all types of early retirement.

Normal, phased, premature and actuarially-reduced retirement rates are calculated using combined data from the DTR and PENSTATS¹⁶. Based on these, annual rates up to the financial year 2016-17 are forecast. These rates are then applied to the projected number

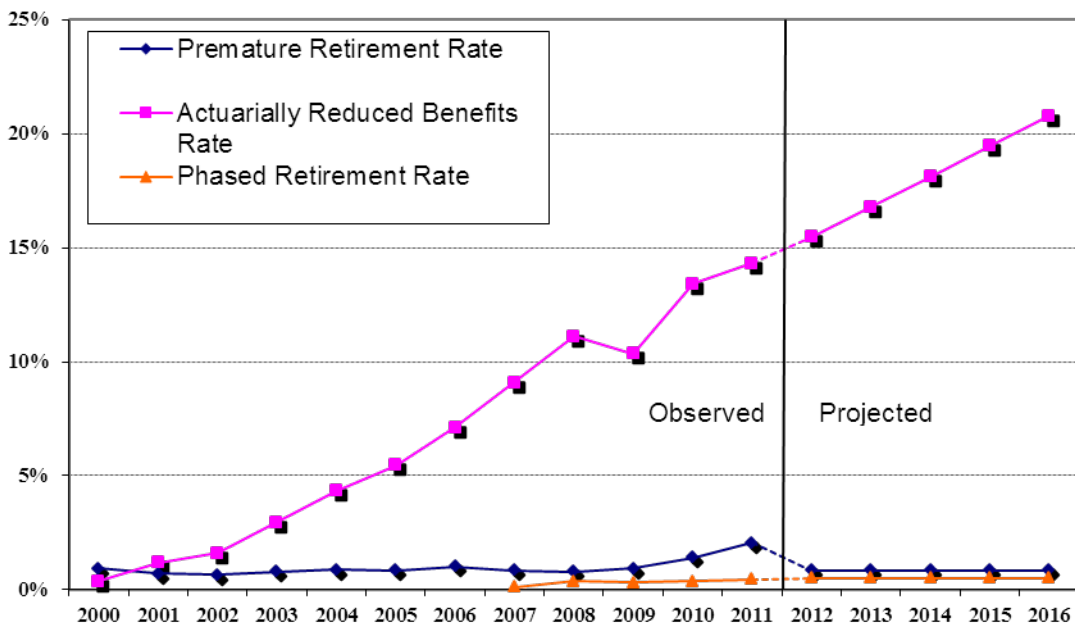
¹⁶ DTR (database of Teacher Records , Section 5.4) and PENSTATS pension data (Section 5.7).

of teachers broken down by age, gender and phase (primary or secondary) to arrive at the number of state-funded teachers expected to take retirement in each year.

Normal retirement is calculated straight-forwardly from the number of teachers reaching retirement age. Early retirement rates are projected based on data trends from recent years. Figure 6 shows the rates of observed and projected early retirements from 2000 to 2016. From 2010, teachers aged 55 and over are eligible for all types of early retirement. The rate of eligible teachers choosing premature retirement and phased retirements has been relatively steady over the past ten years while the rate for actuarially-reduced benefit retirements have been increasing linearly and this trend is assumed to continue. However, the number of teachers eligible for early retirement is falling so despite increasing rates, the overall number of early retirements is expected to decrease over the coming years.

Figure 6: Early Retirement Rates

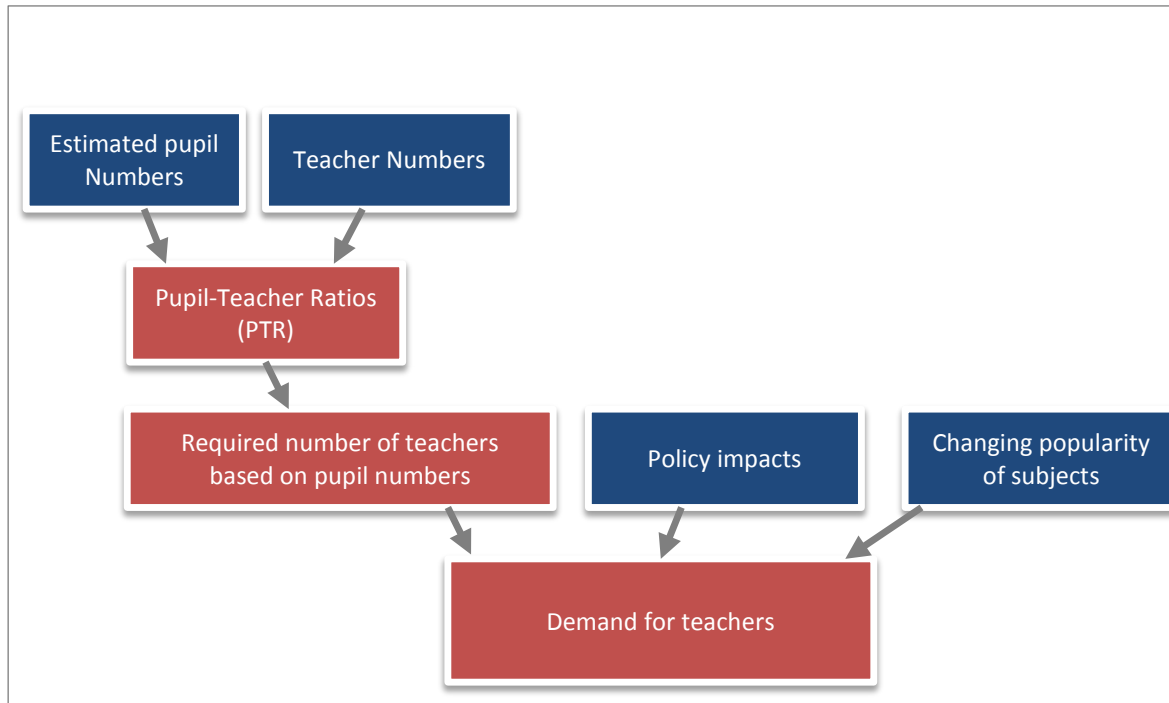
(As a percentage of teachers eligible for early retirement)



Section 3: Estimating the future demand for state-funded teachers

Figure 7 illustrates how the demand for teachers in each year is estimated from projected pupil numbers and other factors (the input data is shown in blue).

Figure 7: Estimating the future demand for teachers



Projected pupil numbers for the next ten years are published regularly by the Department of Education¹⁷. These projections are based on the current pupil numbers in the School Census and future population projections from the Office for National Statistics.

As depicted in Figure 8, numbers in publicly-funded nursery and primary school started increasing in 2010 and are projected to continue rising. Between 2012 and 2016, nursery and primary pupil numbers are projected to increase by 9%.

The numbers of publicly-funded secondary pupils started declining in 2005 and are projected to continue to decline until 2015, after which the increases in primary pupil numbers will start to flow through into secondary.

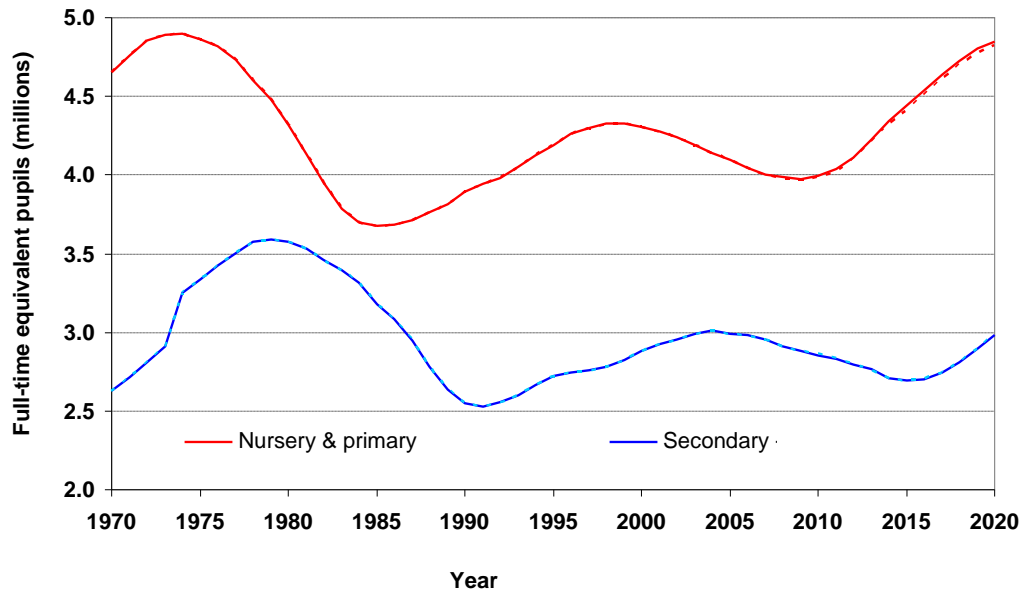
These projections are used to calculate the number of teachers required in a given year using pupil-teacher ratios (PTRs). PTRs vary over time and the Department does not have a specific policy about the desired pupil-teacher ratio, so PTRs are calculated from trends in historical data and are capped so they do not exceed levels seen in the past

¹⁷ [DfE pupil projections publication](#). The next publication in the series is due in December 2013.

decade. For every 1% the primary population increases, historical data suggest that the PTR increases 0.5% up to a cap of 19.83 pupils per primary teacher. Similarly, for every 1% the secondary population increases, data suggests that the secondary PTR increases 0.6% up to a cap of 14.98.

Figure 8: Number of pupils¹⁸ in state-funded schools in England

Years: January 1970 to 2012 (actual) – January 2013 to 2021 (projection)



This base teacher requirement is adjusted by the changing popularity of different subjects and the expected impact of Government policies. For example, the requirement for students failing to achieve C grade GCSEs to continue studying English and maths post-16 is reflected by increasing the demand for maths teachers by an extra 600 teachers a year by 2020. Any policies that will change the number of pupils studying particular subjects or reduce teaching time through additional training (such as the Mathematics Specialist Teachers programme) are taken into account.

The vast majority of teachers employed across all state-funded schools (almost 97 per cent) are qualified, while a small proportion of teachers are occasional or unqualified¹⁹. These include instructors (who are unqualified teachers), where special knowledge and experience are required, on a permanent basis. In 2011, 5.6% of primary teachers fell into this category, and 3.5%²⁰ of secondary teachers. The teacher requirement is

¹⁸ Number of pupils is measured by full-time equivalent (FTE) pupils aged up to and including age 15.

¹⁹ This figure also includes trainee teachers on employment-based routes. This part of the modelling will be reviewed before next year's allocations to consider the effect of School Direct.

²⁰ Source for unqualified and occasional teachers: School Workforce Census. Source for employment-based trainee teachers: NCTL Performance Profiles.

reduced by the quantity of these teachers in recent years to find the required number of regular, qualified teachers.

Section 4: Using the model to determine the required number of ITT places

This section describes how the model calculates the required number of ITT places by comparing the estimated supply and demand of teachers in state-funded schools over the next decade.

4.1 Comparing supply and demand

We calculate the difference between supply and demand by comparing the potential number of entrants in each year with the number of entrants required.

The potential number of entrants to state-funded teaching in each year is calculated by combining the estimated number of new entrants (as discussed in Section 2.2) with the estimated number of teachers outside of state-funded schools seeking to re-enter state-funded teaching (Section 2.3).

The required number of entrants to state-funded teaching is calculated for each year by comparing the demand for state-funded teachers with the supply of state-funded teachers before any new entrants or re-entrants. This base requirement is then adjusted upwards by 9% to ensure a competitive labour market with coverage across all regions of England.

4.2 Calculating the optimum number of ITT places

The model uses an optimisation algorithm to determine the number of ITT places needed to minimise the difference between supply and demand over the next decade.

To ensure stability for the ITT market, restrictions have been placed on year-on-year change in the number of ITT places. These restrictions are based on NCTL's working knowledge of the maximum changes that have been acceptable to providers in the past and are reviewed regularly and adjusted as necessary.

For example, the required number of ITT primary places is not allowed to vary by more than 2000 places from last year's primary requirement. If there was an increase in the number of places last year, a decrease is not allowed in the current year, and vice versa.

These restrictions are built into the algorithm, so that the model outputs the optimal number of ITT places within these constraints. The model aims to achieve a perfect match between supply and demand in each year. Where this is not possible undersupply is double-weighted to reflect that a future shortage of state-funded teachers would be less desirable than a future surplus.

4.3 Ensuring the robustness of the TSM

The estimates in the TSM are based closely on data trends from recent years with adjustments made for known policy changes. The robustness of the TSM is assured by sensitivity testing the model against variations in all of the assumptions.

Section 5: Data sources of the TSM

1. The **NCTL Employment Dataset** provides the number of ITT trainees who are expected to enter teaching after a one or two year break. [Link to NCTL data](#)
2. The **NCTL Performance Profiles** provides the characteristics and outcomes of ITT trainees. [Link to NCTL data](#)
3. The **Trainee Numbers Census** provides the course lengths and numbers of new ITT trainees by route. [Link to Trainee Number Census](#)
4. The **Database of Teacher Records** is derived from teacher pensions data and provides the numbers of active teachers, the number of inactive teachers and the rate of flow between these two groups.
5. The **School Workforce Census** provides information about the number of hours teachers spend teaching each subject and is a secondary source for teacher flows. [Link to School Workforce Census](#)
6. **National Pupil Projections** are used in the demand modelling. [Link to national pupil projections](#)
7. **PENSTATS** is an unpublished teacher pension data source held by the Department for Education which is used to model retirements.
8. **ONS National unemployment statistics** are used in the teacher wastage model. [Link to ONS unemployment statistics](#)
9. **Office for Budgetary Responsibility estimates of Gross Domestic Product** are also used in the teacher wastage model. [Link to OBR GDP estimates](#)

Section 6: Glossary of terms

- **NCTL:** National College of Teachers and Leadership
- **ITT:** Initial Teacher Training
- **PTR:** Pupil-teacher ratio
- **DTR:** Database of Teacher Records
- **SWFC:** School Workforce Census
- **Wastage:** The rate of teachers in publicly-funded schools leaving the profession. This includes teachers leaving to teach in independent schools or other school settings not included in the model.

Annex 7.1 Teacher Supply Model estimates and details of 2014/15 allocations

The Teacher Supply Model calculates the optimum number of ITT places for the next academic year within each of the following priority categories.

- Primary (including nursery)
- Secondary:
 - Mathematics
 - Physics
 - Modern and ancient languages
 - Computer Science
 - Chemistry
 - English
 - All other secondary subjects

For the priority subjects above, the modelling described in this document is performed in full for each subject. Estimates for non-priority subjects are calculated by considering the overall need for secondary teachers and allocating remaining places among other subjects proportionally according to data from recent years.

The outputs of the model for 2014/15 are shown in Table 5 for illustration. The TSM estimates in Table 5 and further details of actual 2014/15 allocations are included in the following publication:

NCTL publication on initial teacher training allocations 2014/15:

[Link to NCTL allocations publication](#)

These national figures are used by NCTL to allocate places to ITT providers, with regional supply examined to achieve a balanced distribution across the country. Further details of the methodology used for allocating ITT places to institutions can be found in the following publications:

NCTL publication on provider ITT allocations methodology:

[Link to NCTL provider allocations methodology](#)

NCTL publication on School Direct allocations methodology:

[Link to School Direct allocations methodology](#)

Table 5: Estimates from the Teacher Supply Model for the academic year 2014/15
 Estimated required number of ITT places for England (excluding Teach First)

Subject	Estimates of the number of ITT places required
Mathematics	2,495
English	1,390
Chemistry	715
Physics	985
Biology	905
Languages	1,390
Design and technology	1,030
Computer science	610
Business studies	265
History	630
Geography	740
Physical education	1,050
Art and design	405
Music	460
Religious education	545
Social studies	215
Other	465
All secondary	14,295
All primary	20,595
Total	34,890



Department
for Education

© Crown copyright 2013

You may re-use this information (excluding logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence or email: psi@nationalarchives.gsi.gov.uk.

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

Any enquiries regarding this publication should be sent to us at: www.education.gov.uk/contactus.

This document is available online at: www.gov.uk/government/publications

Reference: DFE-00278-2013