

Where Workers Come From: An Occupational Flow Account for the United States

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Working Paper AC-WP-2025-01

Version 1.1 (revised September 2026)

Not peer reviewed. Comments welcome.

Abstract

Workforce policy in the United States concentrates on training, on the understanding that an occupation short of people is an occupation short of graduates. This paper builds the full account of where an occupation's people come from and where they go, for 230 occupations, annually from 2009 to 2025 and by age band. It uses a single survey in which each person is counted once on each side, with standard errors from the 160 replicate weights the Census Bureau publishes. Arrivals from other occupations run four to twelve times arrivals from education, exceed all arrivals from outside employment in 99 per cent of occupations, and occur at every age: lateral arrivals aged thirty five and over, taken on their own, outnumber every arrival from education by nearly seven to one. Most of that movement cancels, so the change in occupation sizes that lateral movement produces is about a tenth of the gross flow. The account depends on a measurement result established first. Two independent codings of a job the survey records as unchanged disagree in 48.1 per cent of cases at the detailed level, so occupational mobility cannot be measured in this survey by linking a person across interviews. The within-interview design, whose two codes share an error that cancels in the difference, is the one that measures it.

Keywords: occupational mobility, labor market flows, occupation coding error, Current Population Survey, workforce policy

JEL classification: J62, J24, J21, C81, J08

Suggested citation: Conway, Alessandro (2025). "Where Workers Come From: An Occupational Flow Account for the United States." Working Paper AC-WP-2025-01, Version 1.1.

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First draft November 2025

This version September 2026

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Workforce policy in the United States concentrates on training, on the understanding that an occupation short of people is an occupation short of graduates. This paper builds the full account of where an occupation's people come from and where they go, for 230 occupations, annually from 2009 to 2025 and by age band. It uses a single survey in which each person is counted once on each side, with standard errors from the 160 replicate weights the Census Bureau publishes. Arrivals from other occupations run four to twelve times arrivals from education, exceed all arrivals from outside employment in 99 per cent of occupations, and occur at every age: lateral arrivals aged thirty five and over, taken on their own, outnumber every arrival from education by nearly seven to one. Most of that movement cancels, so the change in occupation sizes that lateral movement produces is about a tenth of the gross flow. The account depends on a measurement result established first. Two independent codings of a job the survey records as unchanged disagree in 48.1 per cent of cases at the detailed level, so occupational mobility cannot be measured in this survey by linking a person across interviews. The within-interview design, whose two codes share an error that cancels in the difference, is the one that measures it.

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1 Introduction

An occupation that cannot find enough people is usually treated as an occupation that has not trained enough of them, and states fund nursing school places, teacher preparation, apprenticeships, and community college capacity on that understanding. The diagnosis has rarely been checked against a full account of where an occupation's people come from, because no such account exists at the level of detail policy operates on. Employment statistics report stocks with precision and at high frequency but contain nothing on the flows that produced them, so an occupation stable in headcount is recorded identically to one replacing a fifth of its people every year.

*Working paper. A companion paper, *Where occupations move*, takes the same question to the states.

This paper builds that account, and on it the diagnosis fails for nearly every occupation the survey can measure. An occupation's workforce is a stock with three inflows, people arriving from education, from other kinds of non-employment, and from other occupations, and two outflows, people leaving for another occupation and people leaving work. Across the occupations covered, arrivals from another occupation run between four and twelve times arrivals from education, and exceed all arrivals from outside employment in 170 of 172 occupations, the two exceptions both agricultural. The arrivals are spread across the age distribution, so they are not graduates recorded under the wrong heading, and lateral arrivals aged thirty five and over, taken on their own, outnumber every arrival from education by nearly seven to one. Most movement between occupations also cancels. The change in occupation sizes that lateral movement produces is a tenth of the gross flow, so an occupation is churned by flows an order of magnitude larger than the change in its size, and a policy that raises arrivals works against departures of comparable magnitude.

The account treats an occupation the way a demographer treats a population, as a stock observed at two dates with the arrivals and departures between them classified by where the person came from or went. It is built from one survey in which each person is counted once on each side, so the identity closes without calibration to any external total. It covers 230 occupations, annually from 2009 to 2025, by age band, with a standard error from the 160 replicate weights the Census Bureau publishes.

Flows themselves have been studied for decades. Work on gross worker flows established that net employment change is the small residual of much larger movements between employment, unemployment, and inactivity (Davis and Haltiwanger, 2014). Work on occupational mobility established that people change occupation often enough for occupation specific human capital to matter for wages (Kambourov and Manovskii, 2008), and that in the monthly Current Population Survey the measured rate depends heavily on whether the interviewer is allowed to carry last month's answer forward (Moscarini and Thomsson, 2007). Recent work treats transitions between occupations as a network with its own structure (Cheng and Park, 2020). None of it produces a table a workforce planner could open and read off, for a named occupation, how many people arrived from training, how many arrived from another occupation, how many left for another occupation, and how many left work altogether.

Assembling one requires settling a measurement question the mobility literature has circled for two decades. Kambourov and Manovskii (2008) devoted substantial effort to spurious transitions arising from independent coding, and Mellow and Sider (1983) showed much earlier that worker and employer reports of the same job frequently disagree. A direct measurement of the problem, on people whose occupation is known not to have changed, has not been available. This paper provides one, and it decides which of the survey's two designs the account can be built on. Section 2 builds the account, Section 3 reports it, Section 4 establishes the measurement result that licenses it, and Section 5 sets out the scope of the measures.

2 The flow account

2.1 Construction

The Current Population Survey records occupation by asking what kind of work a person does, writing down the answer, and coding the description. Its March supplement asks that question twice, once about the present and once about the longest job held during the previous calendar year, and the difference between the two codes is the annual transition used here.

The account uses the seventeen annual supplements from 2009 to 2025, as distributed by IPUMS (Flood et al., 2025), comprising 2,924,246 person records of all ages, of whom 2,231,260 are sixteen or over. Occupation is the OCC2010 variable IPUMS constructs, which maps the 2010 and 2018 Census classifications to one set of 474 codes, so the survey's change of classification in 2020 does not enter any comparison over time. A transition is the pair formed by a person's longest job of the previous calendar year and the job held in the survey week of March. The interval it spans therefore varies across people, and a job held during the year that was neither the longest nor the current one is not seen.

For each occupation and year the account records the number of people whose longest job of the previous year was in the occupation, the number arriving from education, from other non-employment and from another occupation, and the number departing to another occupation or out of employment. Arrivals from outside employment have the previous year occupation code reserved for people who did not work at all, and the stated reason for not working separates education from caring, illness, retirement, and inability to find work. An arrival from education is therefore a person who did no paid work in the previous year because they were studying. A student who held any job during the year is recorded under that job, and arrives in the account as a lateral mover or a stayer. Section 3.2 checks what that does to the figures.

The identity closes to zero people, since every person contributes once to each side from one source and no term is calibrated to an external total.

The 2014 supplement needs a word of its own. It was fielded as a split sample, three eighths of respondents receiving redesigned income questions and five eighths the existing ones, and each half has weights that sum to the full population, so analysing both halves together returns weighted totals twice the size of the population. Filtering on the flag that marks the halves gives 144.8 and 145.5 million employed against 290.3 million unfiltered. Both halves sit on the trend between the 142.6 million of 2013 and the 147.8 million of 2015, and the account keeps the three eighths file, whose questions are the ones carried forward from 2015, with its own weights and replicates.

Standard errors come from the 160 person replicate weights the Census Bureau constructs by successive difference replication (Fay and Train, 1995), with the multiplier of 4/160 the documentation prescribes (U.S. Census Bureau, 2024). Rates are recomputed inside each replicate, since numerator and denominator move together.

2.2 Coverage and precision

Precision degrades quickly as occupations get smaller. The median standard error on the rate of departure to another occupation is 1.3 percentage points where at least three hundred prior year holders are sampled, 2.8 points between one hundred and three hundred, 4.5 points between fifty and one hundred, and 7.1 points below fifty. A cell is reported only where at least one hundred prior year holders appear, a threshold set from that relationship before the estimates were inspected. That leaves 230 occupations reported in at least one year, 172 reported in at least one of the four years from 2022 to 2025, and 148 reported in all four, out of the 474 the survey distinguishes. The four year figures in Section 3 are the mean of the annual rates over the years in which an occupation clears the threshold, and their standard errors take the years as independent, which the overlap of rotation groups between adjacent years makes an approximation.

3 Results

3.1 Arrivals

Table 1 gives the account for eight occupations, averaged over 2022 to 2025 and expressed per hundred people who held the occupation the previous year. Figure 1 shows arrivals and departures on a common scale.

Table 1: Arrivals and departures per 100 prior-year holders, average of 2022 to 2025, standard errors in parentheses

Occupation	Arrivals from			Departures to	
	Education	Other non-work	Another occupation	Another occupation	Out of work
Registered nurses	0.7 (0.1)	0.7 (0.1)	3.4 (0.3)	4.4 (0.3)	4.9 (0.3)
Elementary and middle teachers	0.5 (0.1)	1.1 (0.1)	3.6 (0.3)	4.9 (0.3)	5.4 (0.3)
Secondary teachers	0.5 (0.2)	0.6 (0.2)	7.6 (0.8)	6.7 (0.7)	4.7 (0.6)
Software developers	0.4 (0.1)	0.5 (0.1)	4.1 (0.4)	6.7 (0.5)	5.5 (0.5)
Secretaries and administrative assistants	0.4 (0.1)	1.3 (0.2)	8.0 (0.6)	8.9 (0.5)	7.0 (0.5)
Truck drivers	0.4 (0.1)	2.1 (0.2)	7.7 (0.4)	9.3 (0.4)	9.6 (0.4)
Nursing and home health aides	0.9 (0.2)	1.8 (0.3)	13.1 (0.8)	13.2 (0.7)	9.5 (0.6)
Cashiers	4.8 (0.3)	3.0 (0.3)	8.7 (0.5)	12.3 (0.5)	20.3 (0.7)

The departure columns sit awkwardly beside the way workforce shortage is usually discussed. Registered nurses lose 9.4 per hundred a year, and among the health and education occupations with a million or more holders only physicians, at 8.1, lose fewer; elementary teachers lose 10.3, postsecondary teachers 14.4, teacher assistants 16.8, and nursing and home

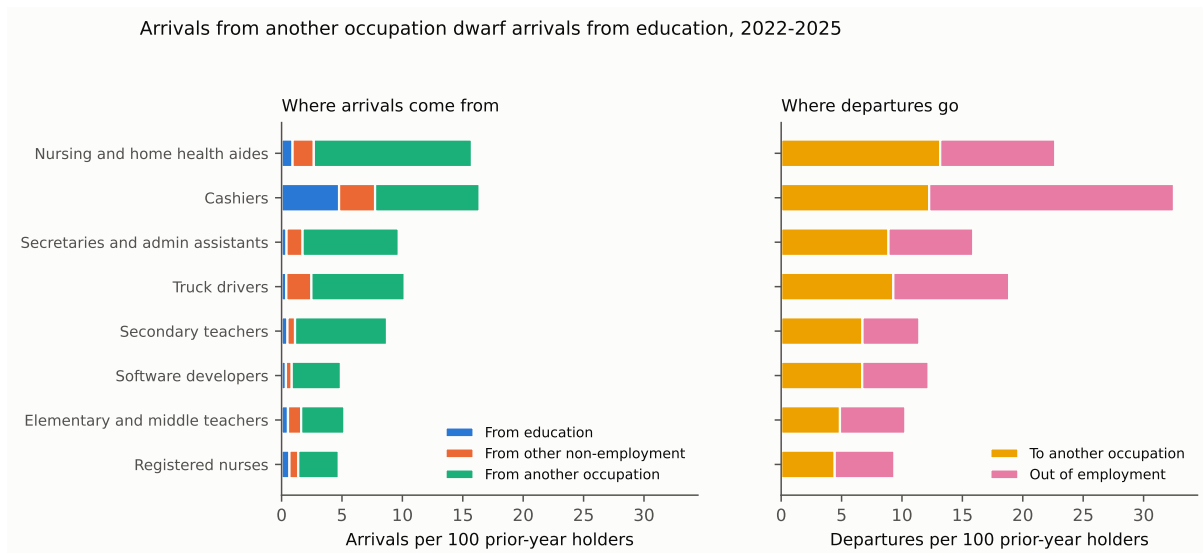


Figure 1: Arrivals from another occupation dominate arrivals from education in all eight, and registered nurses have the lowest total departure rate of the eight.

health aides 22.7. Two thirds of the gap between nurses and aides is movement to other occupations. A nursing shortage, as it is usually discussed, therefore shows in the flows as turnover in the occupations next to nursing, and the aides take in almost as many people from other occupations as they lose to them.

The arrival columns are more lopsided still. Education is the smallest of the three inflows in 83 per cent of the occupations reported, and twenty three of them record no arrival from education at all across the four years. The median occupation takes in nineteen people from another occupation for every one it takes from education, with the middle half of occupations lying between ten and thirty six.

Neither pattern is peculiar to these eight. Figure 2 plots every occupation reported, and 170 of the 172, or 99 per cent, sit above the line where arrivals from other occupations equal arrivals from outside employment. The two below it are farmers and ranchers, and miscellaneous agricultural workers, both of which draw on people who were out of work the previous year. Across the whole matrix, arrivals from another occupation run 4.1 times all arrivals from outside employment at the detailed level, 2.8 at minor group, and 1.6 across the twenty three major groups. At that level the classification cannot confuse a nurse with a physical therapist, and the remaining flow is movement between broad occupational families. Against arrivals from education alone the ratio is 12.1 at the detailed level and 4.7 at the coarsest, and over the full run from 2009 the corresponding figures are 10.6 and 4.0. The lowest the major group ratio falls in any single year is 3.1, in 2012, and the highest is 5.0, in 2024.

3.2 The age profile

Arrivals recorded as coming from another occupation might be graduates who held a job while studying, which would return training to the account under a different heading and would concentrate such arrivals in the youngest bands. Figure 3 shows arrivals from another occupa-

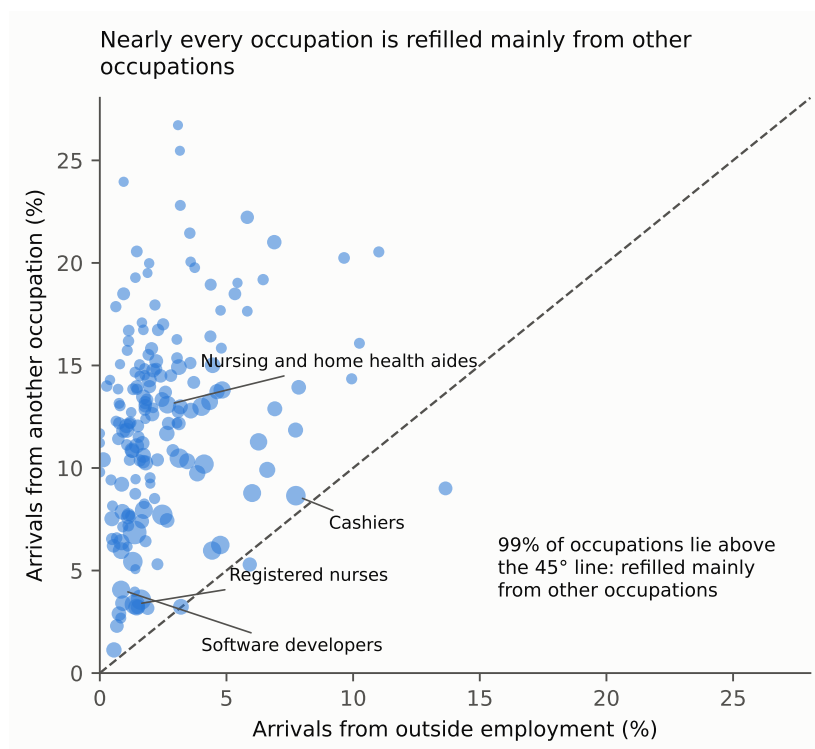


Figure 2: Arrivals from another occupation against arrivals from outside employment, one point per occupation, 2022 to 2025.

tion by age for three occupations, and for registered nurses the rate runs 3.1, 2.2, 3.4, 1.3, and 2.8 per hundred across the bands from twenty five upwards. Between 42 and 51 per cent of lateral arrivals into the three occupations are under thirty five, against 35 per cent of the employed population, and across the whole matrix the figure is 43 per cent, where 92 per cent of arrivals from education are that young. Taking the older bands on their own gives the firmer bound: lateral arrivals aged thirty five and over, few of whom can be graduates under another heading, come to 6.8 times all arrivals from education at the detailed level, 4.4 at minor group, and 2.2 at major group.

Training could also appear in the lateral column by a second route, the person who earns a credential while working in a different occupation, the aide who qualifies as a nurse being the obvious case. The linked sample of Section 4 records education on both March visits. The share of lateral arrivals whose recorded attainment rose over the year is 10.3 per cent against 8.5 among people whose occupation was unchanged, an excess of under two points, and 8.0 against 7.4 from age thirty five. The comparison registers a change in degree level only, so a certificate or a licence obtained while working does not appear in it. Attainment is also recorded afresh at each visit, so the 8.5 among stayers is the noise in the recording. Even so, a large flow of people arriving with a new degree would show as a large excess, and the excess observed is under two points.

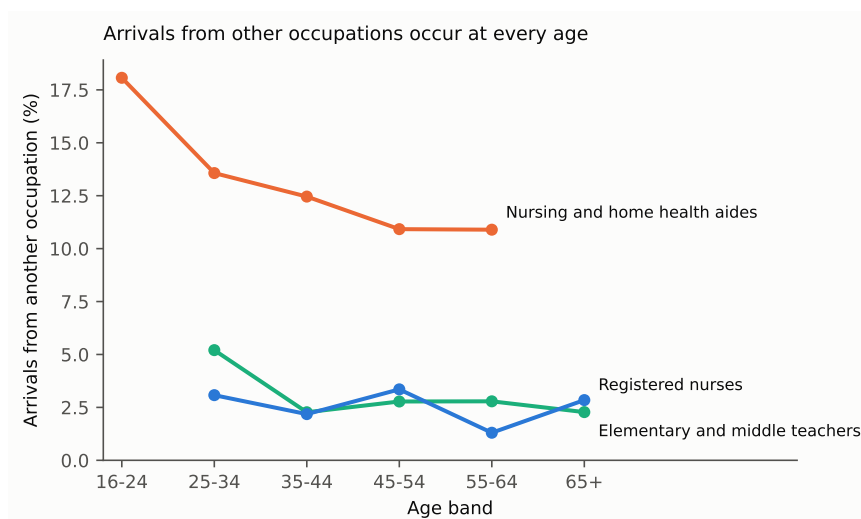


Figure 3: Arrivals from another occupation occur at every age.

3.3 Direction and churn

Gross movement between occupations is large and most of it cancels. How much cancels depends on what is being asked, and the transition matrix supports two summaries of it. The first sets, for each pair of occupations, the flow in one direction against the flow in the other and sums the absolute difference over pairs, which gives the movement a pair does not return. The second takes each occupation's net lateral inflow, its arrivals from all other occupations less its departures to them, and sums the absolute values over occupations, halved so that each mover is counted once, which gives the change in the size of occupations that lateral movement produces. The first bounds the second from above, since an imbalance on one pair can be undone around a cycle of occupations.

At the detailed level, gross lateral movement of 18.97 million a year over 2022 to 2025 contains 7.98 million of unmatched pairwise flow and 1.97 million of net change in occupation sizes, 42 and 10 per cent of the gross. At minor group the two shares are 26 and 7.5 per cent, and at major group 16 and 7.3. Over the full period from 2009 the share of net change is 9.1, 7.8, and 7.7 per cent at the three levels.

Both shares are observed quantities, and both overstate real reallocation. Sampling error makes an absolute difference positive where the true flows balance, and coding discordance has no reason to be symmetric on every pair, since the two occupations differ in size and in how readily a description crosses the boundary between them. At every level of aggregation, then, the change in occupation sizes produced by lateral movement is at most about a tenth of the movement itself.

4 Measurement

4.1 Three measures of one transition

The account is built on the supplement's two codes from one interview. The alternative is to follow a person across interviews. The rotation design returns a household to the sample twelve months after its first interview, so the same person appears in March of one year and March of the next, with occupation collected at the time on both occasions and an eight month gap during which no answer is carried forward. Records are matched on the IPUMS person identifier and kept where sex agrees and age has advanced by no more than two years, the check IPUMS itself recommends. Linking the supplement to the March monthly file for the same month gives agreement on current occupation in 99.99 per cent of 504,531 people, so the two files share one coding of the present job. Table 2 sets the two measures of annual movement against a third. Take last year's occupation as recorded at the time, a year earlier, and compare it with last year's occupation as recalled in the supplement: although both describe the same year, they disagree 52.2 per cent of the time.

Table 2: Three measures of the same annual transition, per cent of linked people whose two codes differ, 2017 to 2025

	Detailed (474)	Minor group (97)	Major group (23)
Last year's job, coded then and recalled now	52.2	44.0	33.5
A year apart, two independent codings	50.1	43.0	33.7
A year apart, both codes from one interview	10.3	6.7	3.3

The first two rows are not the same comparison, March of one year against the longest job of that year in the first and March against March in the second, and neither is a measure of pure error, since real movement is present in both. Each compares two independent codings of one person's work, and both sit near fifty per cent, so a linked measure of annual mobility in this survey comes out at the level of the disagreement between two codings and cannot be separated from it. The third row is the supplement's own measure on the same 146,558 people, and on the supplement as a whole it gives 12.2, 8.2, and 4.4 per cent across the three levels.

4.2 Coding error

A disagreement establishes that one of two measurements is wrong without identifying which, and two codes assigned at one sitting from one description could take the same value out of consistency alone.

Restrict attention to people whom the supplement records as having held the same occupation in both years and who worked all fifty two weeks. For these 114,491 people the independently coded occupation from a year earlier disagrees in 48.1 per cent of cases at the detailed level, 41.1 across the ninety seven minor groups, and 31.8 across the twenty three major groups. The figure is an upper bound on discordance, since a person who changed occupation between March of the prior year and the longest job of that year sits in this sample with a real difference between the two codes. The survey's own annual mobility on the same

linked people is, however, 10.3 per cent at the detailed level and 3.3 at major group for a full year, and the window here is shorter than one. Real change of that order cannot move 31.8 per cent of people across a major group boundary. Figure 4 sets the three figures against the movement the supplement measures on the same people.

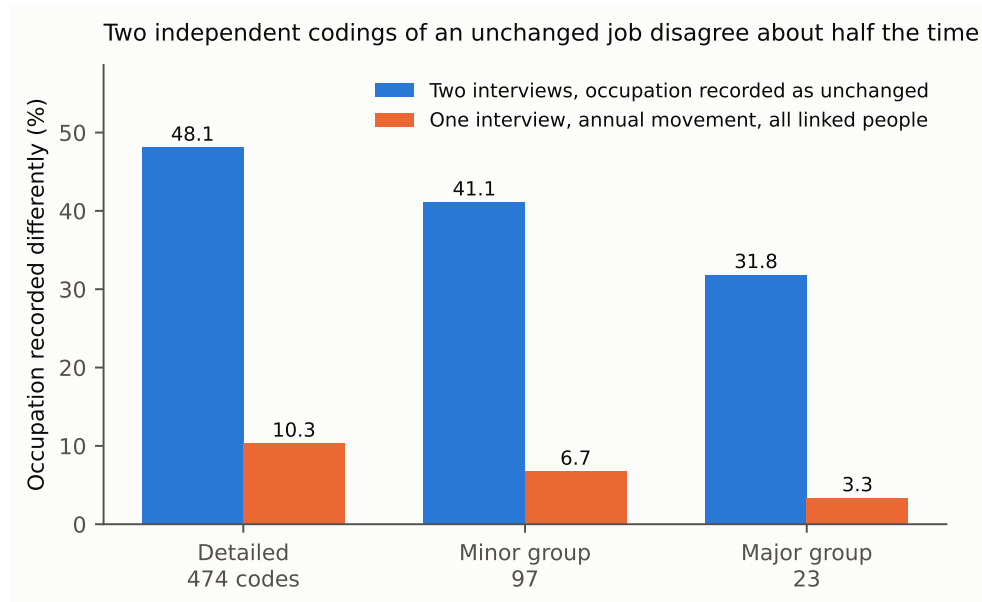


Figure 4: Two independent codings of an unchanged job disagree about half the time. The within interview measure records annual movement several times smaller at every level of aggregation.

The error belongs to the coding, and the case for saying so rests on what the link does not condition on, on the stability of the disagreement over time, and on the shape of the confusions themselves. Sex and state of residence agree across the link by construction, since the sample is drawn by address and the match requires sex to agree, so the informative comparison is with the variables the link leaves free. Education, which people report afresh at each visit and which does change over a year, differs in 12.6 per cent of cases, and occupation in 48.1, which makes occupation by some distance the less reliable of the two. The disagreement holds between 47.4 and 49.6 per cent in all nine year pairs from 2017, including those either side of the survey's 2020 change of occupation classification, which the harmonised codes bridge, and the pandemic years, when real movement did vary.

If the supplement were suppressing real moves, the confusions between the two codings would look like career moves. The largest single confusion is elementary and middle school teachers against secondary school teachers, at 0.96 per cent of all discordance, followed by first line supervisors against the staff they supervise in retail and in offices, by miscellaneous managers against specific managerial categories, by nursing aides against personal care aides, and by accountants against bookkeepers. Each is a boundary in the classification where a description could be coded either way.

The test bounds the disagreement between two independent codings of one job. It does not measure how far a single interview suppresses real change through the consistency of two codes assigned at one sitting, so the 12.2 per cent the supplement reports for the whole population is read here as a lower bound on annual movement.

Discordance concentrates within occupational families and along the supervisory boundary, so the test also identifies which pairs the account should not report on their own. Set a pair's discordance among unchanged jobs against the flow the supplement records between the two, both per hundred holders of either occupation. For registered nurses against physical therapists, a pair whose recorded flow invites suspicion, discordance runs 0.07 against a recorded flow of 0.89, so a second independent coding would add about a twelfth to the flow. For elementary against secondary teachers it runs 14.5 against 1.5, nearly ten times the flow, and for nursing aides against personal care aides 13.5 against 3.1. The teacher pair, and any pair like it, is reported only at a level of aggregation containing both.

5 Scope

The prior occupation is the longest job of a calendar year and the current one is the job of a single week, so the count of people who held an occupation last year covers a twelve month window while the count of current workers is a moment. The ratio between the two is therefore not a growth rate. Occupations also differ in seasonality and in how many jobs their people hold, and the longest job rule treats them differently in ways the account does not correct for.

The survey looks back one year, so arrivals from outside employment include people returning to an occupation they had held before alongside those entering it for the first time. A departure is the statement that a person whose longest job last year was in the occupation is not in it in the survey week, which a single transition cannot separate from a temporary absence.

6 Conclusion

In 99 per cent of the occupations the survey can measure, most arrivals come from other occupations, at four to twelve times the rate of arrivals from education and at every age. The ratio holds at a level of aggregation at which the classification cannot confuse adjacent professions, and it holds when everyone under thirty five is removed. Most of the movement cancels, leaving the change in occupation sizes at about a tenth of the gross flow.

Training capacity therefore adds to the smallest of an occupation's inflows, and a state that funds training places to relieve a shortage is acting on the margin the account shows to be the least important one. The largest inflow is governed by what determines who can move into an occupation from another one: credential requirements, licensure, and the transferability of skills between adjacent occupations. The survey does not record a credential earned while working in another occupation, though the linked sample puts a low ceiling on how many lateral arrivals have a new degree, and such arrivals matter most in the licensed occupations. Which of those barriers binds, and for which occupations, is the question the account was built to make askable, and the companion paper begins on it with the question of where, within the country, the arrivals come from.

The account also settles a measurement question. Two independent codings of an unchanged job disagree in half of cases, so a panel that follows people between interviews measures the coding rather than the movement. The retrospective design looks the weaker instrument because it relies on recall, yet it is the one that measures occupational mobility in this survey, because its two codes share an error that the difference removes.

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