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Assessing the Fiscal Costs and Benefits of A8 Migration to the UK*

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Abstract

This paper assesses the fiscal consequences of migration to the UK from the Central and Eastern European countries that joined the European Union in May 2004 (A8 countries). We show that A8 immigrants who arrived after EU enlargement in 2004 and who have at least one year of residence, and are therefore legally eligible to claim benefits, are 59 per cent less likely than natives to receive state benefits or tax credits and 57 per cent less likely to live in social housing. Furthermore, even if A8 immigrants had the same demographic characteristics as natives, they would still be 13 per cent less likely to receive benefits and 29 per cent less likely to live in social housing. We go on to compare the net fiscal contribution of A8 immigrants with that of individuals born in the UK, and find that in each fiscal year since enlargement in 2004, irrespective of the way that the net fiscal contribution

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is defined, A8 immigrants made a positive contribution to the public finances despite the fact that the UK has been running a budget deficit over the last few years. This is because they have a higher labour force participation rate, pay proportionately more in indirect taxes and make much less use of benefits and public services.

I. Introduction

Immigration is the cause of much debate in receiving countries about the potentially negative consequences an influx of immigrants may have on the welfare of incumbent residents. Of particular concern is whether immigrants 'pay their way' in the welfare system. The belief that immigrants 'take out' more than they 'put in' is reflected in responses to questions in surveys of public attitude: according to the 2002 European Social Survey,[1] 57 per cent of the UK population believed that immigrants were taking more out of the welfare system than they put in, while only 11 per cent thought that immigrants were net contributors.

These fears were voiced in the debate following the European Union (EU) enlargement of 1 May 2004 when the Central European countries Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia joined the EU. Citizens of these countries were granted immediate right of free movement across all EU countries, though access to national labour markets could be restricted by national governments for a transition period of up to seven years. Only Ireland, Sweden and the UK allowed immediate access of new Central European citizens to their labour markets.[2]

Concerns about the fiscal impact of migration on the incumbent natives and on the UK's public finances are often expressed in the popular press: '[Eastern European] Economic migrants need schools for their children. They need housing. They need medical care. They can even lose their jobs';[3] 'Jobs dry up but Poles stay to reap the benefits'.[4] In a recent interview with *The Times*, the Immigration Minister Phil Woolas acknowledged that fears of immigrants exploiting the British social security system may give rise to anti-immigration sentiments and suggested that some restrictions to welfare access may be needed. An extract from *The Times* summarises:

> The problem, according to the minister, is that 'the perception that immigrants jump the housing queue is very strong, even though the reality is very different. We must

[1]This is the only wave of the European Social Survey in which such a question was asked.

[2]As of June 2009, restrictions to the free movement of A8 labour were still in place in Austria and Germany only. Finland, Greece, Italy, Portugal and Spain lifted all restrictions in 2006, Luxembourg and the Netherlands in 2007, France in 2008 and Belgium and Denmark in 2009.

[3]'Honesty's the best immigration policy', *Daily Mirror*, 24 July 2006, http://www.mirror.co.uk/news/columnists/parsons/2006/07/24/honesty-s-the-best-immigration-policy-115875-17435755/.

[4]*Daily Mail*, 8 January 2009, http://www.dailymail.co.uk/news/article-1108806/Jobs-dry-Poles-stay-reap-benefits.html.

> cut back on the few cases of abuse so people see that the system is fair'. He is appalled by stories of immigrants being given £1 million houses at taxpayers' expense. 'These are council decisions. They shouldn't do that kind of thing. I just think it's wrong, even if it is rare.'[5]

Are these concerns regarding the impact of migrants on the UK's public finances justified? Do A8 immigrants make a positive contribution to the UK fiscal system, or do they receive more payments than they contribute in taxes and National Insurance? Are they more, or less, likely than natives to claim welfare benefits or to live in social housing? This paper will address these questions. We first analyse the welfare dependency of A8 immigrants and natives to assess whether A8 immigrants are more or less likely to receive benefits or to live in social housing than natives. We then evaluate the fiscal impact of A8 immigration to the UK for the fiscal years 2005–06, 2006–07, 2007–08 and 2008–09, by comparing the direct benefits of migration through the receipt of additional tax contributions with the direct cost of migration due to provision of government services to these immigrants and their families. Our results suggest that A8 immigrants are far less likely to receive benefits or live in social housing than natives; furthermore, they contribute significantly more to the tax and benefit system than they receive. These conclusions are primarily driven by the characteristics of the A8 population, who generally are younger and better educated and have fewer children than natives. However, our analysis shows that, even if these individuals were identical to the British native-born in all of these characteristics, welfare and social housing receipts of the new A8 immigrants would still be lower than those of the native population.

In Section II, we present a summary of the previous literature on the fiscal consequences of immigration and describe A8 immigration against the institutional setting. Section III goes on to describe the data used in the paper and outlines a descriptive analysis of the characteristics of the A8 population. In Section IV, we present our regression analysis, outlining the relative probability of A8 immigrants and natives being in receipt of welfare payments or living in social housing, and we describe our assessment of the A8's net fiscal impact. We discuss our results and outline the likely dynamic evolution in Section V.

II. Background

1. Previous literature

The stock of literature studying the fiscal impact of immigration is surprisingly small when compared, for instance, with the number of papers

[5] 'Phil Woolas: lifelong fight against racism inspired limit on immigration', *The Times*, 18 October 2008, http://www.timesonline.co.uk/tol/news/politics/article4965568.ece.

that attempt to estimate the labour market effects of immigration.[6] A number of papers have investigated the extent to which immigrants are more or less likely than natives to draw upon government assistance[7] and/or whether immigrants assimilate into or out of the welfare state.[8,9] These studies typically use either multiple cross sections or panel data to evaluate the use of welfare programmes by immigrants and natives, between different cohorts of immigrants or for immigrant cohorts over time.

Analyses of this type can control for individual characteristics and provide important insights into the way immigrants interact with government welfare programmes. However, these studies fail to provide a definitive assessment of the net fiscal effects of immigration because they focus on a limited number of welfare benefits and do not consider the value of taxes paid by immigrants.

Another group of studies has instead focused on the net fiscal impact of immigration.[10] Papers assessing the overall fiscal impact of immigration by comparing the difference between benefits received and taxes paid can be classified as either static or dynamic analyses. For any given year, a static analysis calculates the annual net fiscal contribution of immigrants as the difference between the value of taxes paid and the value of government transfers received in that year.[11] Meanwhile, dynamic studies compute the net present value of the lifetime net fiscal contribution of immigrants, and (in some cases) those of their descendants, requiring a large number of assumptions about future decisions and outcomes of both the individual and the government.

The main strengths of the static approach lie in simplicity and straightforwardness: no strong assumptions are required regarding the future behaviour of immigrants or the evolution of fiscal policies. Static analysis addresses the question 'What is the net contribution of a particular group of immigrants to the tax and welfare system over a given time period?'. Static analysis is backward-looking and enables assessment of the contributions of particular cohorts of immigrants to the tax and welfare system over a period

[6]Some of the most recent assessments of the labour market effects of immigration in the UK are Dustmann, Fabbri and Preston (2005), Manacorda, Manning and Wadsworth (2006), Dustmann, Frattini and Preston (2008) and Nickell and Saleheen (2008). Lemos and Portes (2008) study the labour market impact of A8 immigration to the UK and do not detect any effect for natives' wages or unemployment. Blanchflower and Shadforth (2009), in their analysis of the consequences of migration from Eastern Europe on the UK economy, suggest that immigration may have slowed wage inflation through the 'fear of unemployment' mechanism.

[7]See, for example, Borjas and Hilton (1996), Brücker et al. (2002) and Barrett and McCarthy (2007).

[8]See, for example, Borjas and Trejo (1991) and Hansen and Lofstrom (2003).

[9]Barrett and McCarthy (2008) present a recent review of this literature.

[10]See Rowthorn (2008) for a recent review.

[11]Card (2007) – following the suggestion in Edmonston and Lee (1996) – performs a different type of static analysis comparing measures of local spending and local tax revenues across cities with different immigrant concentrations.

for which data are available. This type of analysis provides answers to questions often raised in public debate: for instance, in the case of A8 immigration to the UK, this approach can be used to assess the net contribution of A8 immigrants to the UK since EU enlargement.

However, static analysis cannot provide a projection into the future. For example, it does not address the question 'What is the discounted net contribution of a particular group of immigrants over their life cycle to the tax and benefit system of the host country?'. Dynamic models do allow for such an assessment[12] but are driven by the strong modelling assumptions required regarding immigrant fertility, propensity to return to the country of origin, labour market participation, and future government spending and tax policies; these assumptions can substantially influence the final result and may lead to predictions being unreliable. This is particularly the case for A8 immigrants, as their very recent migration history permits only limited data-based predictions regarding the evolution of their behaviour over time spent in the UK and their return migration patterns.

The analysis provided in this paper does not attempt to predict the future fiscal impact of the existing A8 immigrant population. It instead evaluates the annual net fiscal effect of immigrants from A8 countries settling in the UK since enlargement in 2004.[13] It also assesses the degree to which A8 immigrants obtain benefits, or rely on social housing, in comparison with UK native-born individuals. Previous work has considered the fiscal impact of overall migration;[14] ours is the first study to assess the fiscal impact of A8 immigration to the UK.

2. The 2004 EU enlargement and immigration to the UK

On 1 May 2004, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia became members of the European Union. The EC Treaty guarantees free movement for all EU citizens, meaning that every EU national has the right of employment in any EU member state on the same basis as a national of that country. However, the 2003 Treaty of Accession allowed member states to restrict the employment of new member state nationals for a transitory period of up to a maximum of seven years. Fears that an inflow of immigrants from the new

[12]See, for example, Storesletten (2000).

[13]This analysis excludes consideration of any general equilibrium effects of immigration. In particular, we implicitly assume that A8 immigration did not affect the tax base through changes in the wages of the incumbent UK labour force. We believe this is a reasonable assumption given the small size of the A8 inflow relative to the UK labour force, and it is consistent with the available evidence on the effects of A8 immigration on the UK labour market (see Lemos and Portes (2008), Blanchflower and Lawton (2009) and Blanchflower and Shadforth (2009)). It is also worth noting that immigration may even increase average native wages, and hence the tax base (see Dustmann, Frattini and Preston (2008)).

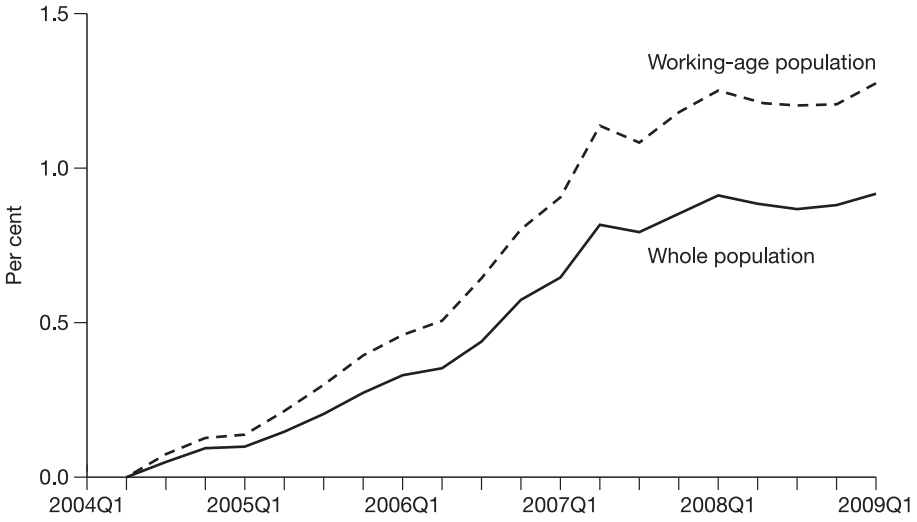
[14]See Gott and Johnston (2002) and an extension to 2003–04 by Sriskandarajah, Cooley and Reed (2005).

member countries could compromise natives' labour market opportunities led most EU15 states to impose some restrictions on the employment of new member state nationals with the exception of citizens of Cyprus and Malta. The remaining eight Central and Eastern European accession countries came to be collectively known as the A8. The Irish Republic, Sweden and the UK were the only EU member states that allowed A8 citizens unrestricted access to their labour markets.

Due to public concern that mass immigration from A8 countries would impact on the UK labour market and impose a burden on the welfare state, the UK introduced the so-called Worker Registration Scheme (WRS) to monitor the inflow of A8 workers. All A8 immigrants intending to work for at least one month in the UK are required to register with the WRS and pay the corresponding registration fee (currently £90). A8 immigrants are also limited in accessing the UK social security system, not becoming eligible for tax credits until they have registered with the WRS, while eligibility for income-related benefits (income support, pension credit, jobseeker's allowance, housing benefit and council tax benefit) occurs only after 12 months of continuous employment. After this period, immigrants are no longer required to be registered with the WRS and can obtain a residence permit confirming their right to live and work in the UK.

FIGURE 1

A8 immigrants as a share of the UK population



Notes: The figure reports the share of A8 migrants in the total (solid line) and working-age (dotted line) population for each quarter. A8 migrants are defined as nationals of the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia who have arrived in the UK since 2004. Working age is aged 16–65 for men and 16–60 for women.
Source: Labour Force Survey, 2004Q2–2009Q1.

Following EU enlargement, the UK witnessed a rapid rise in the resident population of A8 migrants. Figure 1 depicts data from the Labour Force Survey. Between the second quarter of 2004 and the first quarter of 2009, the share of immigrants from A8 countries as a proportion of the UK population increased from 0.01 per cent to 0.9 per cent (solid line), comprising 1.3 per cent of the working-age population by the beginning of 2009 (dotted line). During the same period, the share of foreign-born individuals increased from 8.7 per cent to 11.3 per cent of the total population, meaning that over one-third of the total increase in the foreign population in recent years is due to migration from A8 countries.[15]

III. Data and descriptives

The main source of data used in this study is the Labour Force Survey; we also draw on a number of publications by HM Treasury, the Office for National Statistics (ONS) and several other government departments. Below, we briefly describe each of these data sources and also provide some descriptive statistics.

1. Data

The Labour Force Survey

The British Labour Force Survey (LFS) is a quarterly representative survey of all households residing at private addresses in the UK. Each calendar quarter, approximately 53,000 households are surveyed, representing about 0.1 per cent of the total UK population. The LFS is a rotating panel whereby every household is interviewed for five successive cohorts before exiting the sample. However, the survey excludes individuals who have been resident in their household for less than six months and those who live in communal establishments, meaning that the UK population of recent immigrants is likely to be underestimated.

The LFS provides weights to compensate for differential non-response among different groups of the population. However, as these weights are constructed without taking nationality or country of birth into account, they may be slightly inaccurate for determining the overall size of the foreign-born population. Despite these limitations, the LFS remains the best available source of data on immigrant stocks, and is used for this purpose as well as when determining the labour market status or demographic and socio-economic characteristics of the A8 and native populations. We also use the LFS for our regression analysis of A8 welfare dependency.

[15]See Drinkwater, Eade and Garapich (2006), Blanchflower and Lawton (2009) and Blanchflower and Shadforth (2009) for more descriptive information on A8 immigrants and their labour market outcomes.

As the fiscal year in the UK lasts from April to March, we use the LFS to apportion government expenditures and receipts for the years 2005–06 to 2008–09 by pooling the four relevant quarters of each year (for instance, for fiscal year 2008–09, we pool LFS 2008Q2-Q3-Q4 and LFS 2009Q1).

Government expenditures and receipts

We use tax receipt data from the Budget Reports for 2007 to 2009 (table C6 for years 2009 and 2008 and table C8 for year 2007: 'Current receipts'), as published by HM Treasury.[16] Expenditure data are taken from the Public Expenditure Statistical Analyses (PESA) 2009 (table 5.2: 'Public sector expenditure on services by sub-function, 2003–04 to 2008–09'[17]), also published by HM Treasury.[18]

Other data sources

We also use data from the 2005, 2006 and 2007 *Offender Management Caseload Statistics* (OMCS) and from the June 2008 *Population in Custody Statistics* (PiC), both extracted from Ministry of Justice Statistics Bulletins.[19] We use these data to compute the nationality of the population in prison and to apportion costs of administering the legal system (law courts and prisons).

Information on the distribution of health costs by age group is taken from the 2006 Department of Health *Departmental Report* (figure 6.2: 'Hospital and community health services gross current expenditure by age, 2003–04').[20]

We use the annual ONS publication *The Effects of Taxes and Benefits on Household Income*[21] (ETB) for years 2005–06 and 2006–07 (the latest available year) to compute effective tax rates for VAT and other consumption taxes by decile of household disposable income. The ETB uses data from the Expenditure and Food Survey to analyse the extent to which taxes and benefits redistribute income between households in the UK, and provides detailed information on both gross and net income, cash and in-kind transfers as well as on taxes (including indirect taxes) paid according to the position of the household in the income distribution.

The ONS 2006 *Share Ownership* report gives the results of a survey of the ownership of ordinary shares in quoted companies in the UK.[22] The

[16]Available at http://www.hm-treasury.gov.uk/bud_bud09_index.htm.

[17]http://www.hm-treasury.gov.uk/d/pesa09_chapter5.pdf.

[18]Data for fiscal years 2004–05 to 2007–08 are based on out-turn receipts and expenditures, whereas data for 2008–09 are estimates based on figures for the first two quarters only, giving a larger margin for error in the analysis for 2008–09.

[19]Both available at http://www.justice.gov.uk/publications/statistics-archive.htm.

[20]http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/AnnualReports/DH_4134613.

[21]Available at http://www.statistics.gov.uk/hub/economy/personal-finances/personal-income-and-wealth/index.html.

[22]Available at http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=930.

survey, conducted by the ONS, gives details on the beneficial ownership of UK listed companies and, importantly, includes a geographical breakdown of holdings outlining foreign ownership between 1999 and 2006. We use this information in the apportionment of corporation taxes.

2. Immigration from the A8 countries

We define an A8 immigrant as a national of an A8 country who arrived in the UK in 2004 or later.[23] In Table 1, we report descriptive statistics for A8 immigrants, pooling all quarterly waves from the second quarter of 2004 to the first quarter of 2009. The figures suggest that A8 immigrants are substantially younger and better educated than the native population. Male A8 immigrants are on average almost 12 years younger than native-born men (26 vs 38), while women are 15 years younger than their native-born counterparts (25 vs 40). Moreover, 70 per cent of A8 men and 67 per cent of A8 women are between the ages of 20 and 35, while only 19 per cent of native men and 18 per cent of native women fall within the same age bracket.

We measure education as the age at which individuals left full-time study. An alternative measure is provided in the LFS data and permits classification according to the UK education system; however, due to the difficulties in reconciling international education systems, we do not use this measure.[24] Instead, we assign to the category 'low education' all individuals who left full-time education at 16 or younger, the category 'intermediate education' to all individuals who left full-time education between the ages of 17 and 20, and finally 'high education' to all individuals who left full-time education aged 21 or over. According to this classification, 32 per cent of A8 men and 40 per cent of A8 women are highly educated, while only 18 per cent of native men and 16 per cent of native women fall into this category. Conversely, the share of A8 migrants with a low education is around five times smaller than that of natives.

A8 immigrants have a higher labour market attachment than natives, with a labour market participation rate[25] of 95 per cent for men (83 per cent among natives) and 80 per cent for women (75 per cent among natives). A8 immigrants, particularly men, also have higher employment rates:[26] 90 per cent of men and 74 per cent of women of working age have a job (where

[23]The LFS does not allow identification of the month of arrival, so we cannot separately identify immigrants who arrived before and after May 2004.

[24]The LFS variable 'hiqual' classifies all foreign degrees as 'other qualification'. See the appendix of Manacorda, Manning and Wadsworth (2006) for a discussion.

[25]Labour market participation rate is the percentage of the total working-age population who are employed, self-employed or looking for a job.

[26]Employment rate is the percentage of the total working-age population who are employed or self-employed.

working age is defined as 16–65 for men and 16–60 for women). These figures compare with 78 per cent and 71 per cent among native men and women respectively.

Despite the higher level of education among A8 immigrants, their average hourly wages are considerably lower than those of natives. This disadvantage is apparent across the whole wage distribution: Table 1 suggests that A8 immigrants' median wages, along with wages measured at the 10th and 90th percentiles of the wage distribution, are substantially lower than those of natives for both men and women (wages are real wages in 2005-equivalent pounds, discounted using the quarterly 2005-based consumer price index). While the average (median) hourly wage for A8 immigrant men is £6.81 (£6.07), it is £11.91 (£9.76) for native-born men, and the native–A8 gap is larger at the top of the wage distribution than at the bottom.

TABLE 1

A8 immigrants and UK nationals: descriptive statistics, 2004 to 2008

	A8 immigrants		Natives	
	Men	*Women*	*Men*	*Women*
Average age (years)	26.5	25.1	37.7	39.8
Percentage aged 20–35	69.8	67.3	18.6	18.0
Education[a]				
Percentage low	11.9	10.0	58.3	53.9
Percentage intermediate	56.1	50.2	24.1	29.6
Percentage high	32.0	39.9	17.6	16.5
Labour market				
Employment rate[b] (%)	90.4	74.2	78.3	71.1
Participation rate[c] (%)	94.9	80.4	83.0	74.6
Wages[d] *(£)*				
Average hourly wage	6.81	5.98	11.91	9.46
Median hourly wage	6.07	5.57	9.76	7.73
10th hourly wage percentile	4.48	4.14	5.19	4.68
90th hourly wage percentile	9.42	8.18	20.94	16.42
Welfare				
Percentage claiming benefits or tax credits	12.4	23.7	24.2	55.0
Percentage in social housing	6.5	7.7	15.9	18.3

[a]Defined based on the age at which individuals left full-time education. 'Low': left education at 16 or younger; 'intermediate': left aged 17–20; 'high': left at 21 or older.
[b]Defined as the percentage of the total working-age population who are employed or self-employed.
[c]Defined as the percentage of the total working-age population who are employed, self-employed or looking for a job.
[d]Real hourly wage discounted using the quarterly 2005-based consumer price index (CPI).
Source: Labour Force Survey, 2004Q2–2009Q1, pooled.

The statistics in Table 1 are based on pooled quarterly LFS data from the second quarter of 2004 to the first quarter of 2009, incorporating many different A8 immigrant arrival cohorts. How do the wages of new immigrants develop with time spent in the UK? Although we do not have longitudinal data, it is possible to follow the same arrival cohort of A8 immigrants through the LFS to investigate changes in outcomes for that given arrival cohort over time; we present results of this exercise in Table 2. The first panel refers to average hourly wages. The numbers show a remarkable increase in average wages with time spent in the UK: for example, the wages of the 2004 arrival cohort have increased by 40 per cent four years after migration; wage growth for later cohorts follows a similar pattern. Mean wage growth across all arrival cohorts has averaged around 5 per cent per year, which is substantial compared with the real wage growth of natives over the same period, as can be seen from the last row of the panel, at just over 1 per cent per year.

The increase in wages of A8 immigrants is slightly higher at the 10^{th} than at the 90^{th} percentile of the distribution: for the 2004 arrival cohort, the respective numbers are 45 per cent and 36 per cent until 2008–09. Again, wage growth of native-born workers over the same period has been much lower, as indicated by the numbers in the last rows of the respective panels.

The last two panels of Table 2 report employment rates and participation rates, again following the same arrival cohort. For the cohort that arrived in 2004, the employment rate grew by 13 percentage points (or 18 per cent) over the next four years and was more than 10 percentage points higher than that of native-born workers by 2008–09. The participation rate likewise slightly increased, and is higher for A8 migrants than for native-born workers even just after arrival (with the exception of the last cohort, which arrived in 2008).

The data suggest that A8 immigrants are more highly educated than native-born workers and that, despite this, they receive far lower wages on average. Yet their wage growth in the first four years of arrival is remarkable and far higher than that of native-born workers during the same period. The immigrants also have very high employment and participation rates, with employment rates increasing even further during the first years after arrival.

It should be noted that the figures presented in these tables do not account for differences in education or labour market experience between the two groups. A8 immigrants are younger on average than British-born workers (see Table 1), which may partly explain their lower wages along with their steeper wage growth profiles. However, the figures in the tables suggest that A8 immigrants, after an initial disadvantage, enjoy a period of rapid wage growth, which may be explained by the transference of home-country-specific human capital to the needs of the UK labour market and by improved information about better and more suitable job opportunities.

TABLE 2

A8 immigrants' hourly wages and employment by cohort

	Year of arrival	Fiscal year				
		2004–05	*2005–06*	*2006–07*	*2007–08*	*2008–09*
Average wage (£)	2004	5.67	6.41	6.64	6.74	8.01
	2005		6.04	6.78	6.84	6.84
	2006			5.84	6.05	6.51
	2007				5.40	6.17
	2008					5.72
	Natives	*10.36*	*10.60*	*10.76*	*10.92*	*10.89*
Median wage (£)	2004	4.77	5.75	6.05	6.09	7.31
	2005		5.51	6.05	6.24	6.33
	2006			5.31	5.68	5.88
	2007				5.22	5.77
	2008					5.48
	Natives	*8.44*	*8.62*	*8.75*	*8.85*	*8.83*
10^{th} percentile wage (£)	2004	3.32	4.23	4.38	4.39	4.81
	2005		3.97	4.32	4.60	4.64
	2006			3.86	4.20	4.62
	2007				3.77	4.57
	2008					4.37
	Natives	*4.72*	*4.92*	*4.88*	*5.00*	*4.98*
90^{th} percentile wage (£)	2004	8.11	8.29	9.16	8.82	10.97
	2005		8.44	8.65	9.46	9.56
	2006			8.35	8.21	8.97
	2007				7.10	8.00
	2008					7.76
	Natives	*18.16*	*18.57*	*18.82*	*19.12*	*19.10*
Employment rate (%)	2004	72.3	78.9	88.2	90.1	85.1
	2005		82.4	86.3	87.5	85.5
	2006			74.4	82.0	87.1
	2007				75.1	80.9
	2008					68.6
	Natives	*75.1*	*75.1*	*74.8*	*74.8*	*74.4*
Participation rate (%)	2004	84.9	84.1	92.5	94.9	89.4
	2005		89.7	89.9	90.5	89.9
	2006			85.1	86.6	90.0
	2007				85.0	84.3
	2008					78.5
	Natives	*78.7*	*78.8*	*79.0*	*78.9*	*79.3*

Note: The table reports the evolution over time of the average, median, 10^{th} percentile and 90^{th} percentile of real hourly wages (discounted using the 2005-based CPI) and of employment and participation rates for each A8 immigrants' arrival cohort and for natives.
Source: Labour Force Survey, 2004Q2–2009Q1.

As the LFS does not allow us to follow the same individuals over time, selective out-migration may lead to these numbers being an over- or under-estimate of wage and employment growth profiles from an individual's perspective. However, from a welfare point of view, the figures in Table 2 are the most relevant as they measure the contribution of those immigrants who reside in the UK.

IV. Analysis

1. Welfare dependency

We now turn to the question as to whether A8 immigrants are more or less likely than natives to receive public transfers, investigating the receipt of state benefits or tax credits, and the likelihood of living in social housing.[27] Since an A8 immigrant's eligibility for many benefits is limited until he/she has been in continuous employment in the UK for a period of 12 months (see Section II.2), we initially restrict our analysis to those immigrants who have been in the UK for more than one year. However, from the LFS we know only the year of arrival in the UK and not the exact month, which, despite this one-year restriction, may mean our analysis includes individuals who have been in the UK for less than 12 months.[28] In order to avoid this, we then further restrict our attention to A8 immigrants who have been in the UK for two or more years to ensure that all individuals included in the analysis have been in the country for at least 13 months.

Panels A and B of Table 3 report regression results from the following model:

$$(1) \qquad y_i = \alpha + \beta A8_i + \gamma' X_i + \tau_t + \varepsilon_i$$

where i is an index for individuals, y is a dummy variable alternatively indicating whether the individual receives any state benefits or tax credits (columns 1–3) or indicating whether the individual is living in social housing (columns 4–6), *A8* identifies A8 immigrants who have been in the UK for at least one year (panel A) or for at least two years (panel B), τ_t are time effects (year–quarter interaction) and X is a vector of other control variables including gender, education, age and the number of dependent children in the household.[29] We allow the error term ε to be correlated over time for the

[27]Unfortunately, we have no information about the value of the benefit received, nor on the length of the welfare spell.

[28]The LFS variable 'CAMEMT', which records the month of arrival in the UK, is only available since 2008.

[29]Specifically, we include age and age squared, dummy variables for low and intermediate education as defined in Section III.2 (high education is the excluded category), employment status, current disability, no dependent children under 19 in the household and the number of dependent children under 19 in the household.

same individual, but not across individuals; we account for this by clustering the standard errors at the individual level. We limit the sample to natives and A8 immigrants with at least one (results reported in panel A) or two (results reported in panel B) years of residence. The coefficient β can therefore be

TABLE 3

Probabilities of receiving state benefits or tax credits and of living in social housing

		Benefits or tax credits			Social housing		
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
A	A8 in the UK for at least one year	–0.233***	–0.115***	–0.053***	–0.097***	–0.054***	–0.049***
		(0.007)	(0.008)	(0.006)	(0.004)	(0.005)	(0.005)
B	A8 in the UK for at least two years	–0.195***	–0.078***	–0.027***	–0.090***	–0.041***	–0.035***
		(0.009)	(0.010)	(0.008)	(0.006)	(0.006)	(0.006)
C	A8 in the UK for one year	–0.298***	–0.179***	–0.098***	–0.109***	–0.079***	–0.073***
		(0.008)	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)
	A8 in the UK for two years	–0.205***	–0.079***	–0.024*	–0.092***	–0.045***	–0.039***
		(0.011)	(0.012)	(0.010)	(0.007)	(0.008)	(0.008)
	A8 in the UK for three years	–0.182***	–0.065***	–0.015	–0.091***	–0.040***	–0.035***
		(0.015)	(0.016)	(0.013)	(0.009)	(0.010)	(0.010)
	A8 in the UK for four years	–0.187***	–0.095***	–0.052**	–0.084***	–0.033*	–0.027*
		(0.021)	(0.022)	(0.018)	(0.014)	(0.014)	(0.014)
	A8 in the UK for five years	–0.208***	–0.115***	–0.095**	–0.070**	–0.015	–0.010
		(0.034)	(0.034)	(0.032)	(0.023)	(0.025)	(0.025)
Year and quarter effects		Yes	Yes	Yes	Yes	Yes	Yes
Gender		No	Yes	Yes	No	Yes	Yes
Education and age[a]		No	Yes	Yes	No	Yes	Yes
Dependent children[b]		No	No	Yes	No	No	Yes
No. of observations in panels A and C		1,458,811	1,260,239	1,258,677	2,201,626	1,260,856	1,259,296
No. of observations in panel B		1,455,868	1,257,457	1,255,895	2,198,053	1,258,071	1,256,511

[a]'Education' includes three dummy variables for different levels of education: high (left full-time education at 21 or older), intermediate (left between 17 and 20) and low (left at 16 or younger). 'Age' includes age and age squared.

[b]'Dependent children' includes a dummy variable for having no dependent children under the age of 19 in the household and the number of dependent children under the age of 19 in the household.

Notes: The table reports results from separate regressions of the dummy variable 'receiving state benefits or tax credits' (columns 1–3) and of the dummy variable 'living in social housing' (columns 4–6) on:

- in panel A, a dummy variable identifying A8 immigrants who have been in the UK for one year or more;
- in panel B, a dummy variable identifying A8 immigrants who have been in the UK for two years or more;
- in panel C, the interaction of the A8 dummy with dummies for years since migration.

The reference groups are natives in all cases. Additionally, all specifications include an interaction of year and quarter dummies.

Robust standard errors in parentheses are clustered at the individual level.

* denotes significance at 5 per cent; ** denotes significance at 1 per cent; *** denotes significance at 0.1 per cent.

interpreted as the difference in the probability of receiving state benefits between eligible A8 immigrants and natives, conditional on variables included in the vector X.

Column 1 in Table 3 reports the results from a regression including only year and quarter variables as control variables. The reported parameter is the raw difference in the probability of claiming state benefits or tax credits between A8 immigrants and natives. The figures suggest that A8 immigrants have a probability of receiving state benefits or tax credits that is 23.3 percentage points lower than that of natives. Additionally, panel B demonstrates that even if we limit our attention to A8 immigrants with at least two years of residence in the UK, the coefficient reduces only slightly. The estimate implies that A8 immigrants who have been in the UK for at least two years are still 19.5 percentage points less likely than natives to receive benefits or tax credits. As the average probability of receiving benefits or tax credits among natives is 39.7 per cent (see also Table 1), this means that A8 immigrants have a 59 per cent (49 per cent if they have been at least two years in the UK) lower probability of being in receipt of welfare assistance than natives. Thus, if we compare the A8 immigrant population in the UK over the period between 2005 and 2009, the probability of claiming state benefits or tax credits is substantially smaller for A8 immigrants than for natives.

One reason for the lower probability of receipt might be that A8 immigrants are very different in their demographic characteristics from the native-born population. In columns 2 and 3 of Table 3, we gradually make A8 immigrants more 'similar' to natives, by adding additional control variables, leading to a reduction in the size of the estimated coefficient. In the specification with full controls, the coefficient drops to –0.053 when we consider A8 immigrants with at least one year of residence and to –0.027 when we limit our attention to A8 immigrants with at least two years of residence. This implies that if A8 immigrants were identical to natives in their educational background, age and gender composition and number of dependent children, they would still be 5 percentage points (or 13 per cent) less likely than natives to claim state benefits or tax credits.[30] Even if we adopt a stricter definition and consider only A8 immigrants resident in the UK for at least two years who are observationally equivalent to the native population, the migrants would still be almost 3 percentage points (7 per cent) less likely to claim benefits or tax credits.

[30]Notice that the sample size shrinks as we include additional regressors. As a robustness check, we estimate the unconditional coefficient for the same sample that we use in the regression results reported in column 3. The estimated coefficient is –0.214, which is smaller than the estimate of –0.233 reported in column 1 of the table. This suggests that the estimate in column 3 underestimates the difference in the claiming probability between the two groups due to sample attrition.

Another reason why A8 immigrants are less likely to receive benefits or tax credits than natives could be their awareness of the workings of the UK welfare system, particularly in the initial period after arrival. If this is the case, we would expect their probability of receiving benefits or tax credits to increase with time spent in the UK. We investigate this possibility by modifying the previous regression to include interaction terms of the A8 dummy with dummies for one, two, three, four and five years since migration. The regression equation thus becomes

$$(2) \qquad y_i = \alpha + \sum_{j=1}^{5} \beta_j A8_i \times I_i^j + \gamma' X_i + \tau_t + \varepsilon_i$$

where I^j is a dummy variable that identifies immigrants who have been in the UK for j years; given our definition of A8 immigrants (see Section III.2), $j = 1,...,5$.

The estimates of the coefficients β_j are reported in panel C of Table 3. Column 1 shows that A8 immigrants are less likely than natives to receive state benefits or tax credits irrespective of time spent in the UK. Moreover, the probability of receiving transfers does not appear to increase with years since migration. The effect of time in the UK in fact seems to be U-shaped: after one year in the UK, A8 immigrants have a probability of receiving benefits that is 30 percentage points (75 per cent) lower than that of natives; after three years in the UK, the probability is 18 percentage points (46 per cent) lower; and after five years of residence, the difference in probability is 21 percentage points (52 per cent). When we control for all the individual characteristics in X, the size of all coefficients decreases, but the pattern of effects is again U-shaped, with the implied magnitudes also similar to those obtained in panels A and B. Notice also that given the small number of A8 immigrants in our sample, when we disaggregate them by years since migration and additionally control for a set of other covariates, the precision of the estimates decreases substantially. In particular, results in column 3 show that the negative coefficient estimated for the differential probability of A8 immigrants who have been in the UK for three years of being on welfare, β_3, is not statistically significant. Despite this, we cannot reject the hypothesis that A8 immigrants who have been in the UK for two years are equally likely to receive welfare transfers as those who have been in the UK for three years.[31]

We have replicated this analysis to estimate the probability of A8 immigrants living in social housing, with the results reported in columns 4–6 of Table 3. Column 4 shows that the unconditional probability of an A8 immigrant with at least one year of residence in the UK of living in social housing is 10 percentage points lower than that of natives (panel A), while

[31] A test of the hypothesis $\beta_2 = \beta_3$ gives a p-value of 0.55.

for an A8 immigrant with at least two years of residence the probability is 9 percentage points lower. Over the period 2004 to 2009, 17 per cent of the native UK population were residing in social housing (see also Table 1), suggesting that A8 immigrants are 57 per cent (53 per cent if we only consider those in the UK for at least two years) less likely than natives to live in social housing. As before, as we include more control variables, the coefficient shrinks; but even if A8 immigrants were identical to natives in demographic characteristics and number of dependent children, they would still be 5 percentage points (or 29 per cent) less likely than natives to live in social housing. Even if we restrict our attention to A8 immigrants who have spent at least two years in the UK, the estimates indicate that they are 3½ percentage points (20½ per cent) less likely than natives to be in social housing.

Panel C reports the differences in the probability of living in social housing between natives and A8 immigrants with different years of residence in the UK. In this case, the estimates indicate that over time the differential probability between A8 immigrants and natives tends to decrease, although it is still substantial after five years of residence. A8 immigrants who have spent one year in the UK are 11 percentage points less likely (64 per cent) than natives to live in social housing, while those who have been in the UK for five years are 7 percentage points (41 per cent) less likely to do so than natives. Again, as we include additional control variables (columns 5 and 6), the coefficients get smaller but exhibit the same pattern. Also, the estimates become increasingly less precise, such that β_5 is now not statistically significant. Notice, however, that we cannot reject the hypothesis that the probability of living in social housing is the same for all A8 immigrants who have been in the UK for at least two years.[32]

2. Computing the fiscal impact of A8 immigration

We now turn to a detailed analysis of the net fiscal impact of A8 immigrants on the UK tax and benefit system. As discussed above, our approach compares the transfers made to native-born workers and A8 immigrants against the taxes and National Insurance contributions made. Estimation of these figures is based on various data sources but requires the imposition of a number of assumptions. We will compute various scenarios under different sets of assumptions to demonstrate the robustness of our headline results.

Every year t, the government runs a surplus or deficit, $GSUR$, which is given by the difference between revenues, REV, and expenditures, EXP. In turn, total revenues are calculated as the sum of all the different taxes levied by the government, rev_i (i = 1,…,N_R), where the total number of taxes is denoted by N_R. Furthermore, total expenditures are the sum of N_E different

[32]A test of the hypothesis $\beta_2 = \beta_3 = \beta_4 = \beta_5$ gives a p-value of 0.73.

government expenditures, exp_j ($j = 1,\ldots,N_E$). The total government surplus or deficit can then be written as

$$GSUR = REV - EXP = \sum_{i=1}^{N_R} rev_i - \sum_{j=1}^{N_E} exp_j \ . \tag{3}$$

We can decompose the resulting figure into the net contributions of various populations in the UK at a particular point in time. For our purposes, we divide the total UK population into three groups: A8 immigrants, natives and other immigrants (where 'other immigrants' are the residual group). We can then rewrite equation (3) as

$$\begin{aligned} GSUR = & \sum_{i=1}^{N_R} \alpha_i^{A8} rev_i + \sum_{i=1}^{N_R} \alpha_i^{N} rev_i + \sum_{i=1}^{N_R} \left(1 - \alpha_i^{A8} - \alpha_i^{N}\right) rev_i \\ & - \sum_{j=1}^{N_E} \beta_j^{A8} exp_j - \sum_{j=1}^{N_E} \beta_j^{N} exp_j - \sum_{j=1}^{N_E} \left(1 - \beta_j^{A8} - \beta_j^{N}\right) exp_j \end{aligned} \tag{4}$$

where α_i^G ($G = A8,N$) denotes the share of group G's payments of tax i and β_j^G denotes the share of group G's receipts of government expenditure j.

We can further manipulate (4) to obtain

$$\begin{aligned} GSUR = & \tilde{\alpha}^{A8} REV + \tilde{\alpha}^{N} REV + \left(1 - \tilde{\alpha}^{A8} - \tilde{\alpha}^{N}\right) REV \\ & - \tilde{\beta}^{A8} EXP - \tilde{\beta}^{N} EXP - \left(1 - \tilde{\beta}^{A8} - \tilde{\beta}^{N}\right) EXP \end{aligned} \tag{5}$$

where $\tilde{\alpha}^G = \sum_{i=1}^{N_R} \alpha_i^G rev_i / REV$ and $\tilde{\beta}^G = \sum_{j=1}^{N_E} \beta_j^G exp_j / EXP$ denote the share of total revenues and of total expenditures, respectively, that can be assigned to group G.

In the remainder of this section, we compute these shares using data from government accounts and the LFS for each of the fiscal years from 2005–06 to 2008–09. This enables us to assess whether, in any given year, A8 immigrants under- or over-contribute to total tax payments and to total government expenditure, evaluated by comparing $\tilde{\alpha}^{A8}$ and $\tilde{\beta}^{A8}$, weighted by the share of A8 immigrants in the total population, s^{A8}. It also allows us to investigate whether A8 immigrants are net fiscal contributors. If A8 immigrants contribute more (less) to the tax system than they take out in terms of benefit receipts, then the ratio $\tilde{\alpha}^{A8} REV / \tilde{\beta}^{A8} EXP$ should be larger (smaller) than 1.

This computation depends critically on the criteria chosen to apportion revenues and expenditures, i.e. on the exact definition of the α_i and β_j, which

is not always straightforward and requires a number of assumptions. In the remainder of this section, we explain and discuss the assumptions used in deriving a central scenario, which we consider to be the most reasonable in terms of the assumptions made. To check robustness, we also compute a number of alternative scenarios. Exact details of the specification of each of these methods are provided in the appendix.

Table 4 summarises the criteria used to apportion each category of government receipts, i.e. to construct each α_i, in the central scenario (scenario 1) and under each of the two alternative scenarios. We have

TABLE 4

Government receipts allocation criteria

	Scenario 1 (central scenario)	*Scenario 2*	*Scenario 3*
Income tax and National Insurance	Share of total payments: actual tax and NI rates applied to LFS income	Same as scenario 1	Same as scenario 1
Income tax credits	Share of dependent child population	Approximately 75% as in scenario 1, approximately 25% share of population	Same as scenario 1
VAT and excise duties	Share of total payments: effective rates by household income decile from ONS *Effects of Taxes and Benefits on Household Income* applied to LFS income	Same as scenario 1	Same as scenario 1
Vehicle excise duties	Share of total payments: effective rates by household income decile from ONS *Effects of Taxes and Benefits on Household Income* applied to LFS income	Share of individuals driving to work	Same as scenario 1
Corporation tax and capital gains tax	Share of population, net of foreign-owned share from ONS *Share Ownership*	Same as scenario 1	All to natives, net of foreign-owned share
Inheritance tax	Share of house-owner population	Same as scenario 1	All to natives
Council tax	Share of total households	Same as scenario 1	Share of population
Business rates	Share of self-employed	Share of population	Same as scenario 1
Other	Share of population	Same as scenario 1	Same as scenario 1

Notes: The table summarises the criteria followed to apportion tax receipts for each of the scenarios considered. See Table A1 (and text) for details. Where not specified, the data source is the Labour Force Survey. The list of tax receipts is based on the grouping of items in table C6 of the 2009 Budget Report.

aggregated the 32 main components of public sector receipts from table C6 ('Current receipts') of the 2009 Budget Report into nine groups and depicted these in Table 4; full details on how each component has been grouped are reported in Table A1 of the appendix.

We use LFS information on weekly wages (variable 'grsswk') to calculate the shares of income taxes and National Insurance contributions (NICs) paid by A8 immigrants and by natives. For each individual with wage information in the LFS, we calculate the value of income taxes and NICs paid, applying actual income tax and NIC rates to their taxable income, which is calculated taking into account second jobs and contributions to private pensions (see the appendix for details). For each fiscal year, we can then calculate the total value of income taxes and NICs paid by A8 immigrants and by natives, to estimate their shares of overall payments to the exchequer.[33]

Since, in all years, child tax credits constitute about 75 per cent of total tax credit expenditures,[34] in our central scenario we apportion tax credits according to the proportions of dependent children of A8 immigrants and UK natives. Alternatively, in our second scenario, we calculate for each year the share of child tax credits in total tax credits[35] and use this share to estimate the amount of total tax credits to be allocated according to the proportions of dependent children, allocating the remainder proportionately to the A8 and native shares of the population.

To determine the allocation coefficients for consumption taxes (VAT and excise duties), we proceed in two steps. Table 24 of the ONS publication *The Effects of Taxes and Benefits on Household Income* reports average incomes and average tax payments for several indirect taxes by decile of household disposable income. We use this summary table to construct decile-specific effective tax rates, and then apply these tax rates to individuals within the LFS based on their household's position in the wage distribution.[36] We then proceed as for income taxes, calculating for each year the amount of each

[33]The LFS does not have wage information for the self-employed and therefore they are excluded from this calculation. Taxes on incomes of the self-employed make up less than 15 per cent of total income tax revenues in every year (source: table 3.4 of HM Revenue and Customs, *Survey of Personal Incomes*). As a robustness check, we have calculated in every year the share of total income tax payments due to employees. We have then used this share to calculate the fraction of total income tax payments to be apportioned as described above, and we have allocated the remainder proportionately to the shares of A8 immigrants and UK natives in the self-employed population. Results are virtually unchanged.

[34]Source: table 1.1 of HM Revenue and Customs, *Child and Working Tax Credits Statistics: Finalised Annual Awards, 2007–08* (http://www.hmrc.gov.uk/stats/personal-tax-credits/ctcw-tax-credit-final-may09.pdf).

[35]This share is 72 per cent in 2007–08, 73 per cent in 2006–07 and 75 per cent in 2005–06.

[36]For instance, in 2006–07, the average household income of the bottom decile was £2,262 and the average VAT payment of the same decile was £875, so the effective VAT rate for an individual in the bottom decile of the distribution of household income was 38.7 per cent.

indirect tax paid by A8 immigrants and by natives, to estimate their shares in total payments.

Using effective tax rates based on the position in the wage distribution to apportion consumption taxes means that we are implicitly assuming that A8 immigrants and natives with the same wage also have the same consumption behaviour, which seems unlikely. If we had access to data on the consumption patterns of immigrants and natives, we could more precisely calculate effective tax rates based on actual consumption patterns. However, there are currently no consumption surveys in the UK with information on nationality or country of birth, meaning that a more precise assessment of effective tax rates for consumption taxes is impossible. If A8 immigrants consume less than natives with similar incomes, our apportioning criterion would overestimate their payments in indirect taxes. Since most A8 immigrants are in the lowest deciles of the wage distribution, it is, however, unlikely that they can compress very much of their consumption. For this reason – and in the absence of hard data to test this hypothesis – we believe that even if we may be overestimating immigrants' payments in indirect taxes, the overestimate is not so large as to affect our overall results.

In the case of vehicle excise duties (VED) levied on cars, we also use (in scenario 2) LFS information on whether individuals drive to work to proxy for car ownership. In this case, we apportion VED revenues according to the share of each group in the population of individuals who state that they drive to work.

We apportion corporation tax and capital gains tax taking into account the role of foreign shareholders.[37] In particular, we use the ONS *Share Ownership* information to calculate the percentage of foreign shareholders in UK companies, and subtract their share from the total corporation tax and capital gains tax revenue. We then allocate the remaining share proportionately to the population. This allocation implies that, on average, native-born workers and A8 immigrants own the same share of UK companies' stocks, relative to their share in the population, and contribute to company profits to the same extent. This may be unlikely as A8 immigrants will have had less time to be engaged in entrepreneurial activities.[38] We therefore consider an alternative state under scenario 3, where all corporation and capital gains taxes, net of the foreign-owned share, are allocated to natives.

Taxes on houses are the single largest share of inheritance tax receipts (about 40 per cent of inheritance tax is levied against property, according to HMRC figures[39]) – and properties are also likely to be a good proxy for

[37]Here, we follow Sriskandarajah, Cooley and Reed (2005).

[38]For instance, the LFS shows that the self-employment rate was 7.3 per cent among working A8 immigrants and 12.2 per cent among working natives.

[39]Available at http://www.hmrc.gov.uk/stats/inheritance_tax/iht_126jan09.pdf.

other assets. Thus, in our central scenario, we use the proportions of A8 immigrants and natives in the total population of house owners from the LFS to apportion inheritance tax revenue. However, house ownership is not very common among A8 immigrants (only 5 per cent of A8 immigrants compared with 74 per cent of natives own outright or are buying with a mortgage the house they live in). So this allocation may still be overestimating A8 immigrants' payments, as, due to their age structure, their mortality rates are low. Therefore we also consider an alternative scenario where all inheritance tax is apportioned to natives only (scenario 3).

To allocate council tax payments, we use the proportions of A8 immigrant and native households from the LFS. Alternatively, in our third scenario, we simply apportion council tax payments proportionately to population.

Allocation of business rate receipts is not straightforward. Business rates, a tax on non-domestic property, are typically paid by businesses and other organisations that occupy non-domestic premises. In our central scenario, we therefore use the proportions of A8 immigrants and natives in the self-employed population (from the LFS) to apportion revenue. In scenario 2, we alternatively apportion it proportionately to population shares.

All remaining tax payments are apportioned proportionately to the population. The taxes involved are the three 'environmental' taxes, contributing less than 0.4 per cent of total revenue annually, 'other taxes and royalties', 'adjustments', 'interest and dividends', 'other receipts' and the negative item 'own resources contribution to EC budget'. These taxes do not have any other natural apportioning criterion.

Table 5 summarises the criteria followed to apportion expenditures, i.e. to construct each β_j, in the central scenario (scenario 1) and under the two alternative scenarios. We have aggregated each element of table 5.2 ('Public sector expenditure on services by sub-function') in PESA 2009 into 11 groups. Details on the grouping and a full list of expenditures are reported in Table A2 of the appendix.

A critical issue here is how to allocate expenditures for public goods. Provision of purely public goods – for example, national defence and environmental protection – is to a large extent independent of the number of immigrants, and this is particularly true in the case of a relatively small group such as A8 immigrants. However, here we take a more conservative stance and price 'pure' public goods at their average cost for both immigrants and natives in all scenarios. In other words, we allocate the costs for public goods proportionately to the shares of A8 immigrants and natives in the population. Notice that this is likely to result in an underestimate of the A8's net fiscal contribution and an overestimate of the net fiscal contribution of natives. The alternative is to price 'pure' public goods according to their marginal cost. Assuming that their supply would be

unchanged in the absence of A8 migrants, this would mean spreading the cost among the resident population (natives and previous immigrants) only. This alternative computation would clearly imply an improvement in the net

TABLE 5

Government expenditures allocation criteria

	Scenario 1 (central scenario)	*Scenario 2*	*Scenario 3*
'Pure' public goods	Share of population	Same as scenario 1	Same as scenario 1
Other publicly provided goods and services	Share of population	Same as scenario 1	Same as scenario 1
Law courts and prisons	Share of prison population from ONS *Offender Management Caseload Statistics*	Same as scenario 1	Same as scenario 1
Housing development	Share of social housing tenants	Same as scenario 1	Same as scenario 1
Health (except medical research)	Share of population in age group, and share of total health costs of age group from Department of Health *Departmental Report*	Same as scenario 1	Same as scenario 1
Social protection: social exclusion n.e.c.	Share of income support or family benefits recipients	Same as scenario 1	Same as scenario 1
Compulsory education	Share of children in each age group	Same as scenario 1	Same as scenario 1
Post-secondary education	Share of population studying for qualification	Same as scenario 1	Same as scenario 1
Immigration and citizenship police services	Share of population	Same as scenario 1	Share of immigrant population
Other police services	Share of population	Same as scenario 1	Share of prison population from ONS *Offender Management Caseload Statistics*
Social protection[a]	Share of potential recipients	Share of actual recipients	Same as scenario 1

[a]Except housing, social exclusion n.e.c., R&D social protection and social protection n.e.c.

Notes: The table summarises the criteria used to apportion expenditures for each of the scenarios considered. See Table A2 (and text) for details. Where not specified, the data source is the Labour Force Survey. The list of expenditures is based on the grouping of items in table 5.2 of PESA 2009.

fiscal contribution of A8 migrants and a worsening of the net fiscal contribution of natives. In the appendix, we recalculate all our scenarios adopting this alternative apportionment.

Other public goods and services can, to differing extents, suffer from congestion. For instance, the costs of waste management or the costs for fire-protection services are both likely to increase with population increases. For this reason, under all scenarios, we apportion the expenditures on 'other publicly provided goods and services' proportionately to the shares of A8 immigrants and natives in the total population.

Expenditure on prisons is apportioned according to the nationality of inmates, taken from the Ministry of Justice Statistics Bulletins *Offender Management Caseload Statistics* and *Population in Custody Statistics*. This certainly provides an overestimate of the prison expenditure for A8 migrants as we have no information about the year of arrival of foreign prison inmates, and it is likely – especially in the first years after the enlargement – that nationals from an A8 country who are in prison have arrived before May 2004. As no information is available regarding the number of trials or litigations involving A8 immigrants, we use these same data to apportion expenditures for law courts, again an overestimate for post-2004 A8 immigrants.

Housing development is apportioned proportionately to the shares of the two populations living in social housing, which we calculate from the LFS.

Coefficients for healthcare costs are calculated after taking into account the age structure of the population (again based on the LFS) and the share of gross current expenditures on hospital and community health services for each age group in 2003–04,[40] as detailed in the 2006 Department of Health *Departmental Report*.[41]

Since for all years family benefits, income support and tax credits make up between 84 and 90 per cent of expenditures for 'social exclusion n.e.c.', we apportion this proportionately to the share of each group in the population of income support or family benefits recipients, calculated from the LFS.

We allocate expenditure on compulsory education to the two groups by using LFS information on the proportion of A8 migrant / native children that

[40]These are the latest figures available, and we use them for constructing the coefficients in every year. We are therefore implicitly assuming that health expenditure by age group did not vary over the years we consider.

[41]Although age is the main factor in determining healthcare costs, socio-economic status is another important determinant of health status (see, for example, Smith (2007)). However, we have no information on healthcare expenditure by socio-economic status and age group, so we use age structure only. A8 migrants earn significantly less than UK nationals in all age groups. On the one hand, one may therefore suspect that they may have poorer health status and thus require a higher share of health expenditure. On the other hand, though, the proportion of individuals reporting long-term ill health in the LFS is much lower for A8 migrants than for natives in every age group.

belong to each subpopulation for pre-primary, primary and secondary education. Expenditure on post-secondary education is apportioned by using LFS self-reported information about the qualification for which individuals are currently studying.

Table 5.2 of PESA reports expenditures for two types of police services: 'immigration and citizenship' and 'other police services'. In our central scenario, we apportion both of these elements proportionately to the population shares. However, one could argue that the costs of immigration controls should be charged to immigrants only.[42] We consider this possibility in scenario 3, where police services for immigration and citizenship are apportioned entirely to the foreign-born population (i.e. the natives' share of this cost is zero; the cost is borne only by A8 and other immigrants, proportionately according to their populations). Similarly, expenditure for other police services may increase if the newcomers have a higher propensity to commit crime. We account for this possibility in scenario 3, where we use the share of migrants in the prison population as a proxy for crime activity in each group.

The LFS contains several detailed questions about the type of social security benefits received (but does not detail the value of these benefits). It is therefore possible, in principle, to apportion each type of expenditure for social protection according to the proportions of individuals receiving the relevant benefit. However, due to the small sample size and problems of under-reporting of benefits receipts in the LFS, the direct measurement of recipients of each type of benefit by immigrant status is subject to considerable measurement error. As there are no alternative data outlining benefit receipts by nationality or country of birth,[43] in our central estimate we use *potential* rather than self-declared recipients to apportion social protection expenditures. This is again conservative – it is likely to overestimate the share of benefits received by A8 immigrants both because of legal limits in eligibility (see Section II.2) and because immigrants are usually less likely to take up benefits they are eligible for, especially in the first few years after immigration.[44] Using the proportion of self-declared benefit recipients – as we do in scenario 2 – does not alter the results significantly (see Table 7 later).

[42]See the appendix and Sriskandarajah, Cooley and Reed (2005) for a discussion.

[43]The Home Office Accession Monitoring Report (available at http://ukba.homeoffice.gov.uk/sitecontent/documents/aboutus/reports/accession_monitoring_report/) reports some information about number of accepted and rejected applications of A8 immigrants for a limited number of benefits. However, since the Department for Work and Pensions does not collect nationality data, there is no way of calculating the number of successful (or unsuccessful) benefit applications for natives.

[44]See, for example, Borjas and Trejo (1991) and Borjas and Hilton (1996).

3. The net fiscal impact of A8 immigration

Table 6 reports our results under the assumptions presented in Tables 4 and 5 for the central scenario (scenario 1 in both tables), for fiscal years 2005–06 to 2008–09.

For all fiscal years, A8 immigrants' contribution to total government revenues was similar to their share in the overall population. For example, in 2007–08, A8 immigrants constituted 0.87 per cent of the total UK population and accounted for 0.81 per cent of total government revenues, while in 2008–09 they totalled 0.91 per cent of the population and accounted for 0.96 per cent of total government revenues. This is because, despite receiving lower wages than natives, and hence paying on average lower income taxes, A8 immigrants have very high employment rates. Largely due to this, overall the A8 immigrants' share of total income tax revenues is not proportionately much lower than natives'. Moreover, they also pay proportionately more than natives in indirect taxes, as the effective tax rate for most consumption taxes is higher for low-income individuals. In 2008–09, for example, A8 migrants contributed 0.85 per cent of total income tax revenues and 1.3 per cent of total VAT revenues despite constituting 0.91 per cent of the population. Meanwhile, natives contributed 86.4 per cent of income tax and 87.3 per cent of VAT revenues despite accounting for 88.8 per cent of the population. This gives a ratio of the share of income tax payments to the share in the population of 0.94 for A8 immigrants and 0.97 for natives, with respective figures of 1.4 and 0.98 for VAT.

Moreover, in every year studied, A8 immigrants accounted for a smaller share in government spending than their share of the population (for example, 0.60 per cent in 2008–09, which is far below their share in the overall population of 0.91 per cent). Therefore, overall, A8 immigrants made a net contribution to public finances.

This is illustrated in the last two columns of Table 6, where we report the ratio of revenues to expenditures for both A8 immigrants and natives. In all years, the ratio of tax receipts to expenditures for A8 immigrants was significantly above 1, indicating that A8 immigrants paid substantially more in taxes than they received in government assistance. The figures in the table suggest that the A8 contribution to taxes was over 35 per cent higher than the amount received in direct or indirect government transfers. This is even more remarkable because, over this period, the government was running a budget deficit, which is partially reflected by the ratio of receipts to expenditures for natives, which was below 1 in every year.

We believe that the estimates presented in Table 6 are based on a set of plausible assumptions, which, as discussed earlier, are rather conservative in the sense that they are likely to overestimate the expenditures allocated to

TABLE 6

Results: central scenario (revenues scenario 1, expenditures scenario 1)

Fiscal year	Percentage of population		Expenditures			Revenues			Revenues/expenditures ratio	
	A8 migrants	*Natives*	*Total (£ million)*	*Percentage attributed to A8 migrants,* $\tilde{\beta}^{A8}$	*Percentage attributed to natives,* $\tilde{\beta}^{N}$	*Total (£ million)*	*Percentage attributed to A8 migrants,* $\tilde{\alpha}^{A8}$	*Percentage attributed to natives,* $\tilde{\alpha}^{N}$	*A8 migrants*	*Natives*
2005–06	0.25	90.47	524,173	0.16	91.20	485,700	0.24	86.26	1.39	0.88
2006–07	0.52	89.88	550,116	0.33	90.82	519,700	0.56	85.31	1.60	0.89
2007–08	0.87	89.24	582,676	0.57	90.30	548,000	0.81	84.38	1.35	0.88
2008–09	0.91	88.80	620,685	0.60	89.89	530,700	0.96	83.86	1.37	0.80

TABLE 7

Results: revenues/expenditures ratios under alternative scenarios

Revenues:	Scenario 1		Scenario 1		Scenario 2		Scenario 2	
Expenditures:	Scenario 2		Scenario 3		Scenario 1		Scenario 2	
Fiscal year	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*
2005–06	1.50	0.88	1.26	0.88	1.40	0.88	1.51	0.88
2006–07	1.66	0.89	1.50	0.89	1.61	0.89	1.68	0.89
2007–08	1.38	0.88	1.30	0.88	1.35	0.88	1.38	0.88
2008–09	1.37	0.80	1.34	0.80	1.36	0.80	1.36	0.80

Revenues:	Scenario 2		Scenario 3		Scenario 3		Scenario 3	
Expenditures:	Scenario 3		Scenario 1		Scenario 2		Scenario 3	
Fiscal year	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*
2005–06	1.27	0.88	1.33	0.88	1.44	0.89	1.21	0.89
2006–07	1.52	0.89	1.54	0.89	1.60	0.90	1.45	0.90
2007–08	1.30	0.88	1.29	0.89	1.32	0.89	1.24	0.89
2008–09	1.33	0.80	1.31	0.80	1.31	0.81	1.28	0.81

A8 immigrants and underestimate the contributions made by that same group. However, as previously explained and as reported in Tables 4 and 5, we also consider different allocation methods for both revenues and expenditures.

In Table 7, we present results for all combinations of scenarios. The column headings give the scenario numbers, with reference to the numbering used in Tables 4 and 5. We consider all possible results arising from different combinations of the three scenarios for revenues and the three scenarios for expenditures.

In the first pair of columns, we consider the case where social security benefits are apportioned according to stated receipt, as reported in the LFS (revenues scenario 1, expenditures scenario 2). The net fiscal contribution of A8 immigrants is in this case even larger than before, with the ratio of receipts to expenditures for them ranging from 1.37 in 2008–09 to 1.66 in 2006–07. In the next pair of columns, we still keep the revenue allocation fixed (scenario 1), but consider scenario 3 for expenditures. As explained in Table 5, in this case we are attributing the entire cost of management of the immigration system to the foreign-born population and imputing other police costs proportionately using the share of each group in the prison population. Results under these criteria still suggest that A8 immigrants contribute more than they receive, although the ratio of revenues to expenditures is now slightly lower in every year. For example, in 2008–09 the ratio stands at 1.34, compared with 1.37 in our central scenario.

All other scenarios considered give similar results: a ratio of receipts to expenditures consistently above 1 for A8 immigrants and consistently below

1 for natives. The worst-case scenario (from the A8 immigrants' point of view) is reported in the bottom right-hand corner of Table 7. Here, we consider scenario 3 for expenditures and for receipts, where revenues from corporation tax and capital gains tax, net of the foreign-owned share, and inheritance tax revenues are entirely allocated to natives and council tax revenues are apportioned proportionately to population. In this case, the revenues/expenditures ratio for A8 immigrants in 2008–09 drops to 1.28 while for natives it slightly increases to 0.81.

The results show that, while different choices of apportionment methods may lead to some changes in the revenues/expenditures ratio, A8 immigrants are unambiguously net fiscal contributors, while natives are unambiguously receiving more than they contribute in taxes and National Insurance contributions.

V. Discussion and conclusions

This paper contributes to the debate as to whether immigration after the 2004 EU accession was beneficial to the UK and is the first comprehensive analysis of the net fiscal contribution of A8 immigrants. Our findings suggest that A8 immigrants are highly educated: around 35 per cent (and 17 per cent of natives) left full-time education at or after the age of 21, and only 11 per cent (56 per cent of natives) left school before the age of 17. Despite this, A8 immigrants receive low wages, particularly in the initial period after entry to the UK. However, every entry cohort to date has experienced a remarkable increase in wages since arrival. A8 immigrants are also more likely, on average, to participate in the labour market, and they have higher employment rates than natives. Again, each entry cohort substantially increases its employment rate after arrival, with much higher employment rates after three or four years.

All this paints a very positive picture of A8 immigration to the UK – one of highly educated, young people, entering the UK predominantly to work, with subsequent positive net contributions to the tax system. The analysis also suggests that the labour market situation of immigrants substantially improves with time in the UK, in terms of both wages and labour force attachment.

The lower average wage position of the new immigrants may suggest that their net fiscal contribution is low, as they contribute less to the tax system than comparable natives. However, our analysis suggests that this is, at least partly, offset by higher participation and employment rates. Above all, our study shows that A8 immigrants' receipt of government expenditures, in terms of benefits and other transfers, is substantially lower than their share of population, so, on balance, A8 immigrants have made a significant net contribution to the UK fiscal system. This net fiscal contribution persists in

even the most conservative scenario for tax receipt and expenditure allocation. Thus, from the fiscal point of view, A8 immigration has not been at all a burden on the welfare system but has actually strengthened the fiscal position.

It should be noted that, as we have repeatedly stressed, our estimates give only a snapshot of the fiscal effects of a particular immigrant inflow for a particular period of time (i.e. reflecting the behaviour of immigrants from A8 countries in the immediate post-EU-accession years). As such, our results cannot be used to inform a view of the potential impact of other types of migrations across different time periods. In particular, the current economic downturn may have effects on the net fiscal effects of A8 immigration that are not captured in our analysis. Notice, however, that if natives and immigrants are equally affected by the crisis, then A8 immigrants' net fiscal contribution would still be larger than natives'.

What are the longer-term effects on the fiscal system? As we point out, our analysis is static and backward-looking in nature. But what happens if A8 immigrants age, have children and possibly become more susceptible to illness and disability? As we discuss in the paper, any predictions of future contributions and receipts must rely on a set of very strong assumptions, and we do not wish to engage in such speculation. However, while it is true that younger populations receive less in benefits, it is also the case that younger immigrants, and in particular those who have just arrived, receive lower wages. The strong wage growth of A8 immigrant arrival cohorts that we illustrated is likely to continue with time in the UK, so the contributions that A8 immigrants make to the tax system are likely to rise considerably. In fact, if, in the long run, A8 immigrants receive wages relative to their levels of education similar to those of native-born workers, then – as A8 immigrants are far better educated than natives in the same age cohort[45] – their contributions to the tax system should considerably exceed those of natives. Thus there is, in our view, little reason to believe that in the longer run, A8 immigrants who arrived between 2004 and 2008 will constitute a net burden to the welfare system. This is also in line with analysis we provide on the probability of welfare claims, where we show that A8 immigrants – even if they were identical to natives in a large number of characteristics, such as age, education, children and disability – would still be less likely to claim benefits.

[45]Comparing A8 immigrants and natives aged 25–35 shows that A8 immigrants are considerably more educated even within this cohort: 47 per cent stay in education beyond age 21 and 9 per cent leave education before age 17, which compares with 27 per cent and 42 per cent among natives.

Appendix

In this appendix, we detail the construction of the different allocation coefficients for receipts and expenditures, α_i and β_j. In Tables A1 and A2, we map all items of government receipts and expenditures to the groupings used in Tables 4 and 5. Finally, we report in Table A3 results obtained by replicating the previous analysis (for all scenarios) but apportioning 'pure' public goods according to their marginal cost, i.e. to the pre-2004 resident population only.

Tax receipts

Income tax and National Insurance

Income tax payments and National Insurance contributions are calculated using a simple algorithm based on the LFS variable 'grsswk', which is aggregated to annual salaries, including second jobs alongside the main occupation. After subtracting the lump-sum personal allowance available to all individuals, we make use of data published by the Office for National Statistics from the General Household Survey for 2006, outlining the proportion of individuals with private pensions by age, sex, work pattern and income.[46] Likely pension probabilities are calculated for each income decile by working pattern and sex, and then applied to individual pensionable income to calculate likely pension payments for each observation. The rate of pension payments is set for everyone at the year-specific national average for private sector employees, ranging from 4.0 per cent in 2004 to 4.4 per cent in 2007, the latest year available.[47] These payments are subtracted from gross income to obtain a measure of taxable income, to which the appropriate rates of income tax and NI are applied to calculate approximate personal taxes paid.[48] The LFS does not contain enough detail on individual circumstances to allow consideration of all incidental allowances. However, this is not believed to have a material impact on the results presented here.

Total tax payments are summed within the sample, and α_1 and α_2 are then estimated as the ratio of A8 migrants' and of UK nationals' payments to total payments. These ratios are applied to aggregate tax data for the relevant fiscal year to obtain total tax payments by each group.

[46]http://www.statistics.gov.uk/downloads/theme_compendia/GHS06/GHS06chapter6-Pensions.xls.

[47]Source: chapter 8 of Office for National Statistics, *Pension Trends*, 2009 and 2005 (http://www.statistics.gov.uk/downloads/theme_compendia/pensiontrends/Pension_Trends_ch08.pdf and http://www.statistics.gov.uk/downloads/theme_compendia/pensiontrends2005/Pension_Trends.pdf). Data are available for 2004, 2006 and 2007 only. Therefore we use 2004 figures for 2005, and 2007 figures for 2008. Figures for 2006 and 2007 are our calculations based on a weighted average of contribution rates for members of defined benefit and defined contribution schemes.

[48]For rate guidance and information on income tax and NI structure, see http://www.hmrc.gov.uk/stats/income_tax/index.htm, http://www.hmrc.gov.uk/rates/nic.htm and http://www.hmrc.gov.uk/stats/tax_structure/table-4.pdf.

TABLE A1

List of government receipts and grouping

i	*Revenue source*	*Grouping in Table 4*
1	Income tax revenue	Income tax and National Insurance
2	NICs payments	
3	Income tax credits	Income tax credits
4	Tax credits adjustment	
5	VAT	VAT and excise duties
6	Petroleum revenue tax	
7	Fuel duties	
8	Stamp duties	
9	Tobacco duties	
10	Spirits duties	
11	Wine duties	
12	Beer and cider duties	
13	Betting and gaming duties	
14	Air passenger duty	
15	Customs duties and levies	
16	Insurance premium tax	
17	Vehicle excise duties	Vehicle excise duties
18	Corporation tax	Corporation tax and capital gains tax
19	Corporation tax credits	
20	Capital gains tax	
21	PC corporation tax payments	
22	Inheritance tax	Inheritance tax
23	Council tax	Council tax
24	Business rates	Business rates
25	Landfill tax	Other
26	Climate change levy	
27	Aggregates levy	
28	Other taxes and royalties	
29	Adjustments	
30	Interest and dividends	
31	Other receipts	
32	Own resources contribution to EC budget	

Note: The table reports the list of receipts from table C6 of the 2009 Budget Report (second column), the indexing used in the paper (first column) and the category in which they have been grouped in Table 4 (third column).

Income tax credits

Income tax credits are comprised of child tax credits (CTCs) and working tax credits (WTCs). As in all years CTCs constitute about three-quarters of the total,[49] in our central scenario we apportion tax credits according to the proportion of dependent children that are A8 migrants or UK natives. Alternatively, in our second scenario, we calculate the share of CTCs in total tax credits for each year.[50] We then use this share to calculate the value of total tax credits to be allocated according to the proportion of dependent children (as we do not have the figure for 2008–09, we use the 2007–08 share) and we allocate the remainder proportionately to the A8 and native shares of the population. However, given that tax credits payments are about 1 per cent of total government receipts in every year, the choice of their allocation criteria (α_3 and α_4) will not affect our final results.

Consumption taxes – VAT and excise duties

Consumption tax payments are computed using average effective tax rates by decile of household disposable income (gross annual income less income tax and National Insurance payments) from the ONS publication *The Effect of Taxes and Benefits on Household Income* for 2005–06 and 2006–07. These are then applied to gross individual income. Because the latest available year is 2006–07, we also use effective rates for this year for fiscal years 2007–08 and 2008–09. As with income tax, these figures are totalled and the ratios of payments made by A8 migrants and natives to total payments are calculated for VAT and other consumption taxes ($\alpha_5,\ldots,\alpha_{17}$).[51] This procedure implicitly assumes that immigrants and natives with the same income have the same behaviour. Alternatively, in our second scenario, we try to relax this assumption by using the proportion of individuals driving to work – thought to be a proxy for car ownership – from the LFS to allocate vehicle excise duties (α_{17}).

Corporation tax and capital gains tax

Corporation taxes and capital gains tax ($\alpha_{18},\ldots,\alpha_{21}$) are apportioned using methodology from Sriskandarajah, Cooley and Reed (2005), which subtracts the percentage likely to be paid by foreign shareholders before apportioning the remainder using the percentages of A8 migrants and natives in the sample. We obtain information on the share of foreign shareholders from the ONS 2006 *Share Ownership* report. This provides the annual share of

[49]Source: table 1.1 of HM Revenue and Customs, *Child and Working Tax Credits Statistics: Finalised Annual Awards, 2007–08* (http://www.hmrc.gov.uk/stats/personal-tax-credits/ctcw-tax-credit-final-may09.pdf).

[50]This share is 72 per cent in 2007–08, 73 per cent in 2006–07 and 75 per cent in 2005–06.

[51]For petroleum revenue tax and fuel duties, we use the effective tax rate for duty on hydrocarbon oils, so $\alpha_6 = \alpha_7$. Similarly, we have the same rate for wine and for spirits ($\alpha_{10} = \alpha_{11}$).

foreign ownership in UK companies between 1999 and 2006, with the exception of 2005. We therefore use the 2004 figure for 2005, and similarly we use the 2006 share for all subsequent years.

Alternatively, in our third scenario, we relax the implicit assumption that A8 immigrants and natives generate the same amount of corporation tax and capital gains tax per head by apportioning revenues, net of the foreign-owned share, entirely to natives ($\alpha_{18}^{A8} = \ldots = \alpha_{21}^{A8} = 0;\ \alpha_{18}^{N} = \ldots = \alpha_{21}^{N} = 1$).

Inheritance tax

In apportioning inheritance tax, we use house ownership as a proxy for asset ownership (financial, land and buildings). We calculate from the LFS the percentage of house owners (using the variables 'ten96' and 'ten1') and use it for α_{22}^{A8} and α_{22}^{N}. However, given that A8 immigrants are much younger than natives, we also consider a scenario where all inheritance tax revenue is apportioned to natives ($\alpha_{22}^{A8} = 0;\ \alpha_{22}^{N} = 1$).

Council tax

Council tax payments are apportioned proportionately to the shares of A8 and native households (α_{23}), or alternatively, in our third scenario, according to population shares.

Business rates

Business rates are a tax on non-domestic property, typically paid by businesses and other organisations occupying non-domestic premises. We use the proportions of A8 immigrants and natives in the self-employed population from the LFS as the best proxy to construct α_{24}. Alternatively, in our second scenario, we simply apportion business rates proportionately to population.

Other tax payments

All remaining tax payments are apportioned according to the population shares ($\alpha_{25}^{A8} = \ldots = \alpha_{32}^{A8} = s^{A8};\ \alpha_{25}^{N} = \ldots = \alpha_{32}^{N} = s^{N}$). The taxes involved include the three 'environmental' taxes: landfill tax – levied on waste that is disposed of at landfills; climate change levy – charged on business consumers of taxable commodities for lighting, heating and power; and aggregates levy – a tax on sand, gravel and rock that is dug from the ground or dredged from the sea. These three taxes contribute less than 0.4 per cent of total revenue annually. The remaining receipt categories are 'other taxes and royalties', 'adjustments', 'interest and dividends', 'other receipts' and the negative item 'own resources contribution to EC budget'. None of these taxes has any other natural apportioning criterion.

TABLE A2
List of government expenditures and grouping

j	*Expenditure*	*Grouping in Table 5*
1	1. General public services	'Pure' public goods
2	2. Defence	
3	4. Economic affairs	
4	5.3 Pollution abatement	
5	5.4 Protection of biodiversity and landscape	
6	5.5 R&D environment protection	
7	5.6 Environment protection n.e.c.	
8	6.4 Street lighting	
9	7.2 Medical research	
10	3.2 Fire-protection services	Other publicly provided goods and services
11	3.5 R&D public order and safety	
12	3.6 Public order and safety n.e.c.	
13	5.1 Waste management	
14	5.2 Waste water management	
15	6.2 Community development	
16	6.3 Water supply	
17	6.5 R&D housing and community amenities	
18	6.6 Housing and community amenities n.e.c.	
19	8. Recreation, culture and religion	
20	9.5 Education not definable by level	
21	9.6 Subsidiary services to education	
22	9.7 R&D education	
23	9.8 Education n.e.c.	
24	10.8 R&D social protection	
25	10.9 Social protection n.e.c.	
26	EU transactions	
27	Unallocated	
28	Accounting adjustments	
29	3.3 Law courts	Law courts and prisons
30	3.4 Prisons	
31	6.1 Housing development	Housing development
32	10.6 Social protection: housing	
33	Medical services	Health (except medical research)
34	Central and other health services	
35	10.7 Social exclusion n.e.c.	Social protection: social exclusion n.e.c.
36	9.1 Pre-primary education: under fives	Compulsory education
37	9.1 Primary education	
38	9.2 Secondary education	
39	9.3 Post-secondary non-tertiary education	Post-secondary education
40	9.4 Tertiary education	
41	3.1 Police services: immigration and citizenship	Immigration and citizenship police services
42	3.1 Other police services	Other police services
43	10.1 Sickness and disability	Social protection
44	10.2 Old age	
45	10.3 Survivors	
46	10.4 Family and children	
47	10.5 Unemployment	

Notes to Table A2
The table reports the list of expenditures from table 5.2 of PESA 2009 (second column), the indexing used in the paper (first column) and the category in which they have been grouped in Table 5 (third column).

Expenditures

Pure public goods
In our scenarios in Section IV, costs for pure public goods[52] are attributed to A8 immigrants and natives according to their shares in the population, which is equivalent to charging the average cost of provision to both groups ($\beta_1^{A8} = \ldots = \beta_9^{A8} = s^{A8}$; $\beta_1^{N} = \ldots = \beta_9^{N} = s^{N}$). In Table A3, we also report results for all scenarios in the case where expenditures for public goods are charged at their marginal costs. We then assume that the costs for public goods are only

TABLE A3

Results: revenues/expenditures ratios when public goods are apportioned to pre-2004 residents only (i.e. according to their marginal cost)

Revenues:	Scenario 1		Scenario 1		Scenario 1	
Expenditures:	Scenario 1		Scenario 2		Scenario 3	
Fiscal year	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*
2005–06	2.14	0.87	2.42	0.88	1.85	0.88
2006–07	2.47	0.88	2.63	0.89	2.25	0.89
2007–08	2.03	0.87	2.09	0.88	1.92	0.88
2008–09	2.06	0.79	2.05	0.79	1.99	0.80

Revenues:	Scenario 2		Scenario 2		Scenario 2	
Expenditures:	Scenario 1		Scenario 2		Scenario 3	
Fiscal year	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*
2005–06	2.15	0.88	2.44	0.88	1.86	0.88
2006–07	2.49	0.89	2.65	0.89	2.27	0.89
2007–08	2.04	0.88	2.10	0.88	1.93	0.88
2008–09	2.05	0.79	2.05	0.80	1.98	0.80

Revenues:	Scenario 3		Scenario 3		Scenario 3	
Expenditures:	Scenario 1		Scenario 2		Scenario 3	
Fiscal year	*A8*	*Natives*	*A8*	*Natives*	*A8*	*Natives*
2005–06	2.05	0.88	2.32	0.88	1.77	0.88
2006–07	2.38	0.89	2.53	0.89	2.17	0.89
2007–08	1.94	0.88	2.00	0.88	1.84	0.88
2008–09	1.97	0.80	1.97	0.80	1.91	0.80

[52]In the terminology of PESA 2009, used by us in Table A2, these cover general public services, defence, economic affairs, pollution abatement, protection of biodiversity and landscape, R&D environment protection, environment protection n.e.c., street lighting and medical research.

borne by the part of the population that was already in the UK before the 2004 EU enlargement (i.e. natives and earlier migrants). Results in this case clearly strengthen the findings of our analysis in Tables 6 and 7, as they improve A8 immigrants' net fiscal contribution while worsening that of natives.

Other public goods and services

Not all public services are effectively non-rival, and therefore the increase in population may also increase the cost of providing them. Thus, for those public goods that are – at least to some extent – rival in consumption, we apportion the costs proportionately to population ($\beta_{10}^{A8} = \ldots = \beta_{25}^{A8} = s^{A8}$; $\beta_{10}^{N} = \ldots = \beta_{25}^{N} = s^{N}$). These goods are: fire-protection services; R&D public order and safety; public order and safety n.e.c.; waste management; waste water management; community development; water supply; R&D housing and community amenities; housing and community amenities n.e.c.; recreation, culture and religion; education not definable by level; subsidiary services to education; R&D education; education n.e.c.; R&D social protection; and social protection n.e.c.

For simplicity, we have also included in this category EU transactions, 'unallocated' and accounting adjustments (β_{26}, β_{27} and β_{28}), which – although not public goods – we have always apportioned proportionately to population shares.

Law courts and prisons

Expenditures on law courts and prisons (β_{29} and β_{30}) are allocated to A8 immigrants and natives proportionately to their shares in the total prison population. Information regarding the nationality of prison inmates is taken from the 2005, 2006 and 2007 *Offender Management Caseload Statistics* and from the June 2008 *Population in Custody Statistics*, both Ministry of Justice Statistics Bulletins.[53] It is worth stressing that this measure provides an overestimate of the share of A8 immigrants in the prison population, predominantly because we are not able to separately identify individuals from A8 countries who arrived before and after the EU enlargement of May 2004. We use the proportions of the prison population to apportion expenditures for law courts as well because no data are available about number of trials or litigations by nationality.

[53]http://www.homeoffice.gov.uk/rds/pdfs06/omcsq405tab3.xls (2005), http://www.justice.gov.uk/publications/offender-management-caseload-stats-2006.htm (2006), http://www.justice.gov.uk/publications/prisonandprobation.htm (2007) and http://www.justice.gov.uk/publications/populationincustody-2008.htm (2008).

Housing development

'Housing development' (β_{31}) and 'social protection: housing' (β_{32}) are apportioned according to population share living in social housing calculated from the LFS, based on the variables 'llord', 'land96', 'ten1' and 'ten96'.

Medical and other health services

We apportion medical costs by age for both A8 and native individuals. We use information from the 2006 Department of Health *Departmental Report* (figure 6.2) outlining the share of health costs by age band in 2003–04. These are the most recent available data; therefore we use these figures to apportion expenditures in all years, assuming that the distribution of health costs by age did not vary over the years we analyse. Formally, coefficients are constructed as $\beta_{33}^G = \beta_{34}^G = \sum_{i=1}^{8} h_i a_i^G$, where i indexes the eight age bands, h_i is the share of total health costs of age band i and a_i^G is the share of individuals of group G (G = A8, natives) in age band i.

Education

We apportion expenditure on compulsory education using LFS information on the national composition of population in the relevant age group for each school grade. For pre-primary education, β_{36} is the share of A8 migrants and natives in the population aged 0 to 4; for primary education, β_{37} is the share in the population aged 5 to 10; for secondary education, β_{38} is the share in the population aged 11 to 15. Expenditure on post-secondary education (β_{39} and β_{40}) is apportioned using LFS self-reported information about further education contained in the variable 'qulhi4', which gives details of the qualification for which individuals are currently studying.

This approach does not take into account the proportion of children enrolled in fee-paying schools. Over the period we consider, 7 per cent of school-age pupils in England attended a fee-paying school,[54] and it is likely that these children are disproportionately drawn from the UK national subpopulation. We have therefore also experimented with an alternative apportioning method, where 7 per cent of education costs are apportioned to foreigners only. This does not affect our results.

Police services

Police activities relating to the administration of immigration and citizenship are arguably a public service, and therefore we apportion their cost proportionately to population in our central scenario ($\beta_{41}^{A8} = s^{A8}$; $\beta_{41}^{N} = s^{N}$).

[54]Source: table 2.1 of Department for Children, Schools and Families, *The Composition of Schools in England*, June 2008 (http://www.dcsf.gov.uk/rsgateway/DB/SBU/b000796/index.shtml).

However, it could be argued that these costs should be entirely attributable to immigrants, although this is disputable where expenses for immigration controls are for the primary benefit of natives (see the discussion in Sriskandarajah, Cooley and Reed (2005)). We have also tried apportioning immigration and citizenship costs according to the share in the foreign population. This means that $\beta_{41}^{N} = 0$ and β_{41}^{A8} is equal in every year to the share of A8 immigrants in the total immigrant population (as in our third expenditures scenario).

Other police services are also apportioned according to population share under our central scenario ($\beta_{42}^{A8} = s^{A8}$; $\beta_{42}^{N} = s^{N}$). However, one may fear that immigration may increase crime and hence raise police costs. For this reason, we also checked our results using the share of A8 immigrants and of natives in the prison population as a proxy for crime activity (see the earlier subsection on the apportionment of prison costs for details) in the construction of β_{42}^{A8} and β_{42}^{N} (as in our third scenario).

Social protection

In our central scenario, we generally apportion expenditures on elements of social protection according to *potential* recipients (the exceptions are social security n.e.c., R&D social protection and social protection n.e.c., which we apportion proportionately to population). This is because the LFS variable outlining actual receipt of specific types of benefits, 'tpben31', is often unreliable when we break down the data according to very fine country-of-birth groups, leaving us with few observations for A8 immigrants. However, we also check the robustness of our results using LFS data on *actual* benefit recipients in our second scenario, and it turns out to make little difference. Unfortunately, we have no information as to the *value* of the benefits received, only on the number of recipients.

We apportion social protection for sickness and disability (β_{43}) proportionately according to the composition of those who declare disability in the LFS, based on the variable 'discurr'. Alternatively, we also use the population of self-declared disability benefit recipients resulting from the LFS. Old age and survivors shares ($\beta_{44} = \beta_{45}$) are constructed based on the proportions of A8 immigrants and natives in the inactive pension-age population (women over 60, men over 65), or alternatively in the population of pension recipients. Social protection for family and children (β_{46}) is apportioned proportionately to the shares of A8 immigrants and natives among dependent children (we define as dependent children anyone who is inactive and under the age of 18) or among the recipients of income support or family-related benefits. Expenditure on social protection for unemployment (β_{47}) is apportioned according to the composition of the

unemployed population or according to the composition of unemployment benefits recipients.

Finally, we apportion other expenditures on protection from social exclusion (β_{35}) according to the shares of A8 immigrants and natives among the recipients of income support or family-related benefits recipients, because every year they make up more than 84 per cent of the total expenditure in this category and there is no obvious population of potential recipients to use in an alternative apportionment method.

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