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The Fiscal Effect of Immigration: Reducing Bias in Influential Estimates

Michael A. Clemens

Abstract

Immigration policy can have important net fiscal effects that vary by immigrants' skill level. But mainstream methods to estimate these effects are problematic. Methods based on cash-flow accounting offer precision at the cost of bias; methods based on general equilibrium modeling address bias with limited precision and transparency. A simple adjustment greatly reduces bias in the most influential and precise estimates: conservatively accounting for capital taxes paid by the employers of immigrant labor. The adjustment is required by firms' profit-maximizing behavior, unconnected to general equilibrium effects. Adjusted estimates of the positive net fiscal impact of average recent U.S. immigrants rise by a factor of 3.2, with a much shallower education gradient. They are positive even for an average recent immigrant with less than high school education, whose presence causes a present-value subsidy of at least $128,000 to all other taxpayers collectively.

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Immigrant workers both pay taxes and benefit from public expenditures. If taxes paid are relatively low, an immigrant's arrival can have the net effect of depleting public coffers. This net fiscal effect, and how it varies by skill level, has been central to economists' policy advice on the number and type of immigrant workers that a country should admit (Friedman 1978; Borjas 1995; Smith et al. 1997; Blau et al. 2017; Guerreiro et al. 2020; Busch et al. 2020). This fiscal effect shapes incumbent voters' support for redistribution (Razin et al. 2002; Facchini, Mayda and Murard 2016) in complex ways (Cavaillé and Van Der Straeten 2022), as well as shaping voters' support for immigration restrictions (Facchini and Mayda 2014). And immigration restrictions, for generations, have been designed in part to limit expected negative fiscal effects (Carpenter 1931; Daval 2021).

But too little is known about the magnitude or even the sign of the fiscal effect of immigration. It is typically estimated by methods known to suffer from either bias or imprecision. The most influential method simply counts the direct fiscal flows to and from individual immigrants by education level. It is well known that this partial-equilibrium approach omits substantial indirect, dynamic effects of immigration (e.g. Razin and Sadka 2004), favoring precision at the cost of unknown bias. The usual remedy in the literature, general equilibrium models of indirect effects, addresses bias at the cost of imprecision. Estimates from such models are widely viewed as sensitive to untestable assumptions, reducing their relevance to policy.

This paper proposes a third option, a simple adjustment to the most influential estimates of the net fiscal impact of immigration. The adjustment reduces bias at minimal cost to precision and transparency. It is to include conservative estimates of tax revenue from capital income caused by an immigrant worker's presence in the economy. This is not a general equilibrium effect of immigration, because the effect occurs under the assumption of fixed prices used by the fiscal flow accounting that currently dominates policy analysis. Rather, it is an important effect omitted by those influential, static estimates. It is an effect that does not arise in standard tax scoring of other public policies, whose counterfactual is rarely the outright absence of a given worker from the economy.

Omitting tax revenue from capital contradicts basic economic theory if the firms that employ immigrants are profit-maximizing. Intuitively, after a firm has set its demand for labor and capital to maximize profits, suppose it raises its labor demand by one to hire an immigrant. Without general-equilibrium shifts in prices or productivity, this increase in labor demand would by definition reduce profits if it occurred without also hiring capital—such as buying an additional computer or renting additional retail space for the worker to use. That additional capital must generate additional capital income, in an amount bounded from below by the reservation price of capital. This yields bounds on the consequent capital tax revenue caused by the worker's employment. The alternative, implicit assumption maintained by direct fiscal accounting methods is that firms pay wages to the marginal employed immigrant to *reduce* profits—sacrificing capital income they could have received with a different investment, and thus avoiding the consequent capital taxes.

A simple and general formula can account for this omission, with important effects on influential estimates of the net fiscal impact of U.S. immigration (reviewed by Blau et al. 2017; Blau and Hunt 2019). Conservatively, including the omitted capital tax revenue raises standard partial equilibrium estimates of the marginal recent immigrant worker's effect on tax revenue by a factor of at least 1.73 for gross tax revenue, and by a factor of at least 3.15 for tax revenue net of benefits. For the typical, marginal recent immigrant without a high school education, the adjustment changes the sign of lifetime net fiscal impact: from −$109,000 to at least +$128,000 without including children and grandchildren, or from −$116,000 to at least +$326,000 including children and grandchildren. These figures include all levels of government. Net fiscal impacts after the adjustment still rise sharply with education. But whereas the unadjusted net fiscal impact of an immigrant with a bachelor's degree is larger than that of a an immigrant with high school only by a factor of 30, the same ratio after the adjustment is 2.6.

The contribution of this work is to present a straightforward, transparent way to reduce bias in the most influential present method of estimating the net fiscal impact of immigration (partial equilibrium fiscal accounting) by skill level. It does so without the large number of assumptions inherent to the principal alternative method (general equilibrium modeling) that introduce unknown imprecision. The key additional assumption it requires is profit-maximization by firms in factor markets. It addresses a long literature on the fiscal effects of skill-selective immigration using both partial-equilibrium methods (Smith et al. 1997; Lee and Miller 2000; Auerbach and Oreopoulos 2000; Dustmann et al. 2010; Chojnicki 2013; Dustmann and Frattini 2014; Martinsen and Rotger 2017; Blau et al. 2017) and general-equilibrium methods (Razin and Sadka 1999, 2000; Storesletten 2000; Casarico and Devillanova 2003; Schou 2006; Chojnicki et al. 2011; Battisti et al. 2017; Busch et al. 2020). It also relates to a macro empirical literature on the fiscal impacts of immigration overall, without regard to skill level (d'Albis et al. 2019), and to recent empirical work on the effects of immigrant labor on county-level local public coffers (?) and on firms' capital income (e.g. Mayda et al. 2020; Bahar et al. 2020). It complements recent work by Colas and Sachs (2020) on the indirect fiscal effects of lower-skill immigration via shifts in the wage structure.

The paper begins by reviewing what is omitted in standard estimates of the fiscal effects of immigration (Section 1), and proceeds to derive a formula to account for the omission in existing partial-equilibrium estimates of fiscal impact (Section 2). It discusses at length a strong assumption shared both by the *accounting* and *general equilibrium* methods—that immigration causes no static rise in capital tax income because the capital stock is fixed in the short run, but without a solid theoretical or empirical basis. The paper then gathers the empirical elements needed to implement the adjusted calculation (Section 3). and explores how adjusting existing estimates of the fiscal impact of immigration to include capital tax revenue affects the sign and magnitude of those estimates (Section 4). It then extends the results in several dimensions (Section 5)—to account for potential displacement of native workers by immigrants, relative price effects on heterogeneous labor, monopsony power in the labor market, sector-specific barriers to immigrant employment, capital income by immigrants, and political-economy effects. The paper then discusses why immigration policy in particular requires this adjustment but tax scoring of other types of public policy do not (Section 6), and offers summary implications (Section 7).

1 Current methods

The literature quantitatively estimates the nationwide fiscal impact of skill-selective immigration by two broad methods.[1] The *accounting* method sums the taxes paid directly by immigrants net of public benefits received—immigrants' *net direct fiscal contribution*—assuming that immigration has no long-run effect on prices or productivity. It considers either static accounts of net flows

[1] Surveyed by Kerr and Kerr 2011; Liebig and Mo 2013; Nowrasteh 2015; Vargas-Silva 2015; Hennessey and Hagen-Zanker 2020; Edo et al. 2020.

over a fixed period, or dynamic studies of net flows over lifetimes (e.g. Lee and Miller 2000) or generations (e.g. Auerbach and Oreopoulos 2000). The *general equilibrium* or 'macroeconomic' method attempts to account for indirect, long-run effects of immigration on net fiscal flows by modeling its effect on productivity, economic growth, and the prices of labor and capital (e.g. Storesletten 2000; Casarico and Devillanova 2003; Chojnicki et al. 2011).[2]

Both methods can yield biased estimates. This is well known. Studies using the accounting method dominate the research literature and policy analysis—despite their omission of any long-run ripple effects of immigration—because estimates derived from general equilibrium models vary widely according to the assumptions made.[3] A commission of leading immigration economists convened by the National Academy of Sciences (Blau et al. 2017, 335–336, 343) made "the most up to date and complete compendium of academic research on immigration in the United States" (Shih 2018, 945). That commission provides this explanation for the influence of accounting studies:

> *"They do not take into account indirect (general equilibrium) impacts of immigration on wages, or on labor force participation and occupational choices of the pre-existing population—mainly because these factors are very difficult to estimate credibly. Over time, the reshaping of the labor force, the expansion of capital stock, and any impact on productivity and economic growth brought on by immigration will affect public finances through conduits such as corporate taxes and taxes paid by natives. …In a comprehensive analysis, these ripple effects in the economy would be accounted for; however, due to the complexity of operationalizing a general equilibrium approach into the accounting framework, they typically are omitted."*

[2] These two methods used to quantitatively forecast the fiscal effect of skill-selective immigration are not the only methods used to study the fiscal effect of immigration. A small, third strand of literature uses macroeconomic data to estimate the effect of aggregate immigration on public finances using tools such as vector autoregression (d'Albis et al. 2019), a method that does not allow clear estimates by worker traits such as the level of education. A fourth branch of literature considers the effects of immigration on public coffers through political economy channels, such as the effect of immigration-induced diversity on political support for taxation and redistribution (Preston 2014; Alesina et al. 2018). But this literature does not contain quantitative scenarios for the fiscal effect of immigration adjusted for political economy effects.

[3] The *general equilibrium* method requires assumptions about the long-run, national-level price elasticities of labor demand in order to "consider indirect fiscal effects from changes in macroeconomic variables such as wages, employment, consumption and savings" (Hennessey and Hagen-Zanker 2020, 9). All such models assume some finite price-elasticity of labor demand. This equates to assuming an exogenous, binding constraint on the supply of (physical and human) capital and thus a finite price elasticity of capital supply—by the third law of derived demand (Marshall 1890, 434; Hicks 1932, 242–244). These assumptions are usually viewed as too arbitrary for policymakers to rely on the resulting estimates of fiscal impact.

In other words, estimates of general equilibrium effects are "sensitive to a wide variety of modeling choices" (Edo et al. 2020, 1384), so in policy analysis they are typically assumed to be zero. Only fiscal flows directly from or to immigrants are counted. This choice privileges precision and transparency over unbiasedness.

Blau et al. (2017, 11 *passim*) themselves adopt this assumption, describing their own constant-price, individual-level accounting study as an estimate of "the fiscal impacts of immigrants", as did their predecessor commission 20 years prior (Smith et al. 1997). The literature describes those accounting calculations as "the fiscal impact of immigration" and states that they provide "ample information . . . to formulate selection criteria based on characteristics of prospective immigrants" (Lee 2017, 173). The OECD describes its own accounting estimates as the "fiscal effect of immigration" (Liebig and Mo 2013). Ruist (2017, 217) concludes, "Estimating the true fiscal effect of the presence of an immigrant group is not possible," thus it must be "inferred" from accounting methods that set all other impacts at zero.

This assumption is strong. A precise estimator, like zero, is not by definition preferable to an imprecise estimator regardless of bias (Mayer 1993). Economists recommending real-world action often go further, privileging unbiasedness over precision. In policy discussions Keynes was known to recommend the principle of Carveth Read (1898, 272), "It is better to be vaguely right than exactly wrong", advice later echoed by Nobel laureates from Hayek to Thaler.[4] The method proposed here addresses a large bias at minimal cost to precision, seeking to improve on influential estimates of the fiscal impact of immigration as a guide to policy.

2 Net fiscal effects of immigration with profit-maximizing firms

At first glance, what seems to distinguish the two dominant methods to estimate this fiscal effect is the methods' different assumptions about prices and productivity. By counting cashflows alone, the *accounting* method rules out any effects of immigration on prices and productivity. The *general equilibrium* method allows them. But there is another important difference that

[4] For Hayek (1967, 18 *passim* esp. 260–262), estimates that are more correct "within a certain range" allow policy to "move with greater confidence" even if they do not tell us "precisely what to expect". Thaler (1992, 198) asks economists who advise real-world action, "Would you rather be elegant and precisely wrong, or messy and vaguely right?"

has been little explored in the literature. The more influential *accounting* method omits a large, additional effect that occurs even at constant prices and productivity—that is, without general equilibrium effects. This omission is the tax revenue from capital income caused by employing immigrant labor under the assumption that employers maximize profits.

For example, the firm can rent or buy the use of a car, computer, office, or warehouse for the added worker to use. A profit-maximizing firm *must* do this, barring general-equilibrium shifts in prices or productivity, otherwise the employment of additional labor reduces profits. If it buys the additional capital, it must earn capital income from that purchase that will be taxed; if it rents, the owner will earn capital income from the rental that will be taxed. Such purchases or rentals would not occur without the owners of capital being paid more than the reservation price, which bounds the magnitude of this effect away from zero. In other words, the *accounting* method implicitly assumes that employers choose to pay wages to the marginal immigrant worker without being compensated by additional capital income, an act of charity incompatible with profit maximization.

2.1 The effect of an immigrant worker's employment on production

This can be illustrated easily and slightly more formally for generalized forms of production. Suppose that national output is produced by N identical firms whose production Y is a function of capital K and labor L, so that $Y = F(K, AL)$. Require only that this production function is continuously differentiable with constant returns to scale, and without loss of generality choose units such that the technology parameter $A \equiv 1$. Each firm is small with respect to the national economy.

Euler's homogeneous function theorem gives the product exhaustion rule, a cornerstone of the neoclassical theory of income distribution (Wicksteed 1894; Flux 1894): $Y = wL + rK$. Taking the total derivative with respect to labor, assuming firms demand factors so as to maximize profits $\left(\frac{\partial F}{\partial K} = r, \frac{\partial F}{\partial L} = w\right)$, and substituting in identities for the capital share of income $\alpha = rK^*/Y$ and the labor share $1 - \alpha = wL^*/Y$, we have the effect of additional employment on output,

$$\frac{dY^*}{dL^*} = w \cdot \left(1 + \frac{\alpha}{1-\alpha} + \frac{1}{N}\left[\eta_{LL}^{-1} + \frac{\alpha}{1-\alpha}\eta_{KL}^{-1}\right]\right). \tag{1}$$

Here η_{LL} and η_{KL} are the own-price and cross-price elasticities of factor demand at the level of the labor market, not the firm.

The total effect of hiring an immigrant worker on output (1) combines a fixed-price effect (the first two terms in parentheses) and a variable-price effect (the last term in parentheses). At general equilibrium, the cumulative decisions of many individual firms can affect prices w, r with ripple effects on factor demand. But a price-taking firm cannot affect national prices $\left(\eta_{LL}^{-1} \approx \eta_{KL}^{-1} \approx 0\right)$, so the total effect of additional immigrant employment on each firm is simply

$$\frac{dY^*}{dL^*} = w \cdot \left(1 + \frac{\alpha}{1-\alpha}\right). \tag{2}$$

For example, if the capital share is 1/3, additional labor employment that costs employers \$1 expands output by \$1.50. Here the term $\frac{\alpha}{1-\alpha}$ is the wage "discount" defined by Taussig (1910, 144), the degree to which capital "secures its gain or profit by advancing to the laborers less than they eventually produce"—from the total, not partial, derivative of output with respect to labor.[5]

This additional output beyond the increased wage bill, the second term in parentheses in equation (2), is not a general equilibrium effect realized through long-term price and factor adjustment. It is an instantaneous, static effect required by employers' profit maximizing behavior. Suppose the contrary: that the price-taking employer of the marginal new worker employed less marginal new capital, so that output expanded less than in equation (2). She would be leaving money on the table, choosing to forego profit today that she could have made by borrowing capital at r and employing it at $\frac{\partial F}{\partial K} > r$. If she had already set labor demand L^* to maximize profits at K^*, she would lose money by expanding labor employment without that accompanying capital investment.

2.2 Net effect on fiscal revenue

The portion of additional income (2) that accrues to owners of capital is taxed. This is omitted from cashflow accounting estimates of the fiscal impact of immigrant workers. It is not a general equilibrium effect; it occurs at fixed prices.

[5] The assumption of a stable aggregate capital share requires that the economy overall have a balanced growth path but does not require Cobb-Douglas production by each firm; see e.g. Jones (2005).

Define net fiscal revenue T as the difference between aggregate taxes paid and benefits received. Labor and capital are taxed at the effective rates τ_L and τ_K. Public benefits paid to each unit of labor and capital are b_L and b_K, thus $T \equiv (\tau_L w - b_L) L^* + (\tau_K r - b_K) K^*$.

This yields the net fiscal effect of immigrant labor. As above, assume that firms demand factors so as to maximize profits. As in the *accounting approach*, assume that firms are price-taking $\left(\eta_{LL}^{-1} \approx \eta_{KL}^{-1} \approx 0\right)$.[6] The total fiscal effect of an additional immigrant worker is

$$\frac{dT}{dL} = \left(1 + \frac{\tau_K}{\tau_L} \cdot \frac{\alpha}{1-\alpha}\right)\tau_L \cdot w - b_L. \tag{3}$$

The fiscal impact (3) is not a macroeconomic long-run, general-equilibrium effect. It is an instantaneous static effect at partial equilibrium (fixed factor prices and productivity), an effect required by employers' profit maximization. Gross tax revenue rises by more than the tax on labor, in equation (3), because employers of new labor who had not hired additional capital would have given up profit. Their income from hiring that additional capital, like the income of the additional hired worker, is taxed.

Equation (3) clarifies what is estimated by the most influential current approaches to estimating the fiscal effect of immigration by skill level. The *accounting method* rests on all of the above assumptions, plus one more. If we assume away all revenue from capital income taxation, equation (3) becomes precisely the cashflow accounting method that currently dominates policy analysis:

$$\frac{dT}{dL} = \tau_L w - b_L. \tag{4}$$

That is, the accounting method is a special case of the net fiscal effect (3), in which either capital income does not exist (employers fail to maximize profits), or capital income taxation does not exist, or both. The rest of this paper explores the consequences of dropping those strong assumptions, offering a large reduction in bias at a small cost of reduced precision and transparency. The new estimator (3) has all the limitations of accounting method (4) that currently dominates policy analysis, less one. In all other ways, both methods could be criticized on the same grounds—such as setting aside general equilibrium effects. The goal of this exercise is

[6] Two additional and innocuous assumptions are that the government does not subsidize capital for employing new labor $\left(\frac{db_K}{dL} \equiv 0\right)$, and that the relative subsidy to labor is much larger than to capital $\left(\frac{b_L}{w} \gg \frac{b_K}{r} \approx 0\right)$.

not to make a perfect estimator, but to make a substantially better one that remains simple and transparent enough for relevance to policy debate.

The consequences of the adjustment are substantial. Without the strong assumption of zero capital tax revenue, the accounting method requires a correction given by the parenthetical term in (3). For example, assuming $\alpha = 1/3$ and $\tau_L \approx \tau_K$, the parenthetical correction term in (3) equates to 1.5.[7] After this correction, depending on the relative magnitude of benefits received (b_L), the absolute value of the fiscal effect of an immigrant worker (3) could be arbitrarily larger or smaller in magnitude than the net direct fiscal contribution (4). It could even take the opposite sign.

2.3 Assumptions on capital investment

The short-term effect of labor immigration is sometimes modeled as an exogenous and unforeseen increase in employment—all else equal, including fixed capital. This assumption yields estimates that the effect of immigration on GDP is trivial (e.g. Borjas et al. 1997, 64), which would imply a similarly trivial effect on capital income.

Fixed capital is a very strong assumption that deserves more scrutiny than it has received in studies focusing on labor markets. This assumption interprets immigration as a sudden, unforeseen perturbation of labor supply, with all else (including capital) fixed. Heckman (2000, 54) notes that such a *ceteris paribus* effect of perturbing a vector X of inputs to production may not have real-world relevance. "The assumption that the components of X can be varied independently is strong," Heckman writes, because "economic constraints operating on a firm may restrict the range of admissible variations so that a *ceteris paribus* change in one coordinate of X is not possible". In the present example, for a price-taking firm that has already set its employment of labor L to maximize profits, increasing L without increasing employment of capital K is not possible without reducing profit. The total derivative or reduced-form effect (2) would be the short-term policy-relevant treatment effect (Heckman and Vytlacil 2001). Put differently, the government's admission of an additional immigrant worker does not induce a profit-maximizing, price-taking

[7] The effective (not statutory) tax rates on labor and capital in the United States are roughly equal at $\tau_L \approx \tau_K \approx 27$ percent. In the years where the fiscal effect of immigration has been previously studied, the effective rate on capital was higher (Saez and Zucman 2019, 93). That is, in recent history $\frac{\tau_K}{\tau_L} \gtrapprox 1$.

firm to pay (taxed) labor income to an additional worker. Only additional (taxed) capital revenue does.

Where does the additional capital come from? Firms can adjust capital quickly to employ an additional immigrant worker through in at least three ways that are ruled out by the assumption of fixed capital.

The most obvious is borrowing abroad, which can be done quickly at the global reservation price of capital. Foreigners make gross purchases of tens of trillions in private long-term US securities each year, with a *net* acquisition of private long-term securities of $476 billion over the past year (Treasury 2021). By any measure, these inflows of foreign capital account for a large fraction of all net domestic investment in US private business. It is nevertheless standard for general equilibrium estimates of the fiscal impact of immigration to assume that such capital flows do not occur—so that capital is fixed in the short run and must be accumulated over time by domestic saving (e.g. Storesletten 2000, 314–315; Busch et al. 2020).

A second way that firms can adjust capital very quickly, even in a *closed* economy, is simply for savers and investors to foresee predictable migration. In the workhorse neoclassical growth model with endogenous saving (Ramsey 1928; Cass 1965; Koopmans 1965), consumers who foresee predictable immigration save up enough capital that—even as immigrants arrive—they are paired with just enough additional capital to hold fixed the the capital share of income. Consider a closed economy where a social planner chooses households' consumption c (and thus savings) to maximize the net present value of their utility,

$$\max_c \int_0^\infty e^{-(\rho-n)t} u(c) dt, \tag{5}$$

where $c = \frac{C}{AL} \equiv \frac{C}{L}$ is consumption per effective worker; $u(c)$ is some constant relative risk-aversion utility function; $0 \leqslant \rho < 1$ is consumers' pure rate of time preference; and n is the foreseeable rate of growth in the labor force via immigration. The maximization (5) is subject to the constraint that the capital stock per effective worker rises with all production that is neither consumed nor diluted by population growth,

$$\frac{dk}{dt} = f(k) - nk - c, \tag{6}$$

where $k = \frac{K}{AL} \equiv \frac{K}{L}$ is capital per effective worker; and $f(k) = Y/L$ is production per effective worker. For simplicity, there is no depreciation or technological change. Under the standard additional assumptions of asset-market clearing and the no-Ponzi and transversality conditions (e.g. Barro and Sala-i Martin 2004, 99), the steady-state solution to (5) and (6) is

$$k^* = f'^{-1}(\rho). \tag{7}$$

That is, rational consumers save such that the steady-state interest rate equals their discount rate. In the steady state, the capital stock and national product both grow at the rate of (effective) labor force growth. The capital-labor ratio and the capital share of income are fixed, regardless of the immigration rate n. Thus a *foreseeable* marginal increase in employed labor in the current period *causes* additional saving in prior periods. This additional saving is just enough to allow additional employment of capital in the current period, offsetting the rise in the interest rate that would otherwise have occurred. Consumers who did not do this would be "leaving utility on the table", allowing k^* to fall below its optimal level (7).

The vast majority of US immigration is certainly foreseeable. 79 percent of the variance in the number of immigrants per year, 1940–2019, is explained by a linear time trend alone (DHS 2019, Table 1). Immigration in a typical year is very far from an unexpected shock providing new information to investors. For this reason, first-order short-run constraints on capital adjustment simultaneous with the new employment of immigrant workers, even in a closed economy, require assumptions of irrational or constrained saving behavior not present in parsimonious growth models.

Third, even for the small share of variance in immigration that is not foreseeable, and even in a closed economy, firms can rapidly adjust the hiring of capital to employ new immigrant workers by hiring unutilized capital (e.g. Shapiro 1986). Financial capital held as cash can be immediately borrowed and invested; idle machines and structures can be rented or purchased. Such capital is abundant. The overall capital utilization rate in US private industry has typically hovered between 75 and 80 percent over the past decade (Federal Reserve 2021). Standard closed-economy models of the fiscal impact of immigration in a closed economy nevertheless assume 100 percent capital utilization, so that any new capital employed must be saved or built. In a more realistic setting, retail space to complement newly-hired immigrant salespersons can often be quickly acquired or leased from idle stock; automobiles to complement newly-hired immigrant drivers can be quickly acquired or leased from idle inventory; and so on. The increase in the marginal product of capital that would otherwise accompany the employment of the marginal immigrant worker can simply induce the marginal dollar of unutilized capital to be utilized, without need for accumulation or construction.

These three mechanisms for rapid capital adjustment find strong empirical support. Estimates of average wage effects from immigration cluster tightly around zero (Longhi et al. 2008, 2010) because native and immigrant workers are imperfect substitutes (Peri and Sparber 2009; Manacorda et al. 2012). Systematic reviews of the literature find that lasting effects of immigration on average wages are "very small" (Blau et al. 2017, 5). For the purposes of setting policy, Banerjee and Duflo (2019, 27) write, the conclusion of this literature is that "wages do not go down when there are more migrants". Edo et al. (2020, 1367) conclude that "the impact of immigration on the average wage and employment of native-born workers is zero or slightly positive in the medium to long term".

This point favors the accounting approach to estimating the fiscal impact of immigration. If the inverse price elasticities η^{-1} are not substantial, then the general equilibrium approach offers little reduction in bias to offset the large increase in imprecision from its numerous untestable assumptions. Blau et al. (2017, 343) conclude, "The fiscal impacts literature has generally concluded that these kinds of [general equilibrium] impacts are minor relative to overall economic activity."

But the accounting method, to achieve the transparency and precision that give it primacy in policy analysis, introduces a large and unnecessary bias. It assumes away profit maximization and the resulting capital share of income. The magnitude of capital income is well known, and its existence is unrelated to the debates in the literature about general equilibrium price effects of immigration.[8]

[8] Assuming a zero capital share in equation (2), that is assuming $\frac{dY}{dL} \equiv \frac{\partial Y}{\partial L}$, equates to the labor theory of value, a Marxian tradition with little acceptance in mainstream research (Samuelson 1971).

2.4 Heterogeneity by skill

The discussion so far has focused on a single type of labor. It can be easily extended to labor that is heterogeneous by skill, provided the resulting estimates are carefully interpreted. The proposed adjustment, like the highly influential *accounting method*, estimates the fiscal effect of a policy of expanding or contracting overall immigration *of a given skill composition*.

For example, the net direct fiscal contribution of an immigrant with less-than-high-school does not represent what that person's fiscal contribution would be if *all* immigrants in a given year had less than high school. Instead, it estimates the fiscal contribution attributable to an immigrant with less-than-high-school given that she arrives alongside hundreds of thousands of other immigrants with other education levels. It is appropriate for the influential *accounting method* to do so, because a largely exogenous mix of skills is the defining feature of the U.S. immigration system—where only around 15 percent of immigrants in a typical year arrive on skill-tested employment-based visas, and the vast majority arrive on family-based visas or refugee visas that are not skill tested.

In other words, the principal choice variable from a U.S. policy perspective is the scale of immigration *at a given skill composition*. This reality is most closely reflected not by estimating the *ceteris paribus* effect of freely varying immigration at one skill level unbound by the level of immigration at another skill level. The vast majority of U.S. immigration comprises flows that lack such a policy lever. Rather, in this setting, Heckman and Vytlacil's (2001) policy-relevant treatment effect comes from positing an institutional constraint that requires the number of workers at one skill level to covary with the number of workers at another skill level. This is what the influential *accounting method* does, and that feature is retained in the adjusted estimates here.

To make the same point slightly more formally, suppose that the labor aggregate L is some function of two types of labor, 'low' skill L^ℓ at wage w^ℓ and 'high' skill L^h at wage w^h, so that $L \equiv L(L^\ell, L^h)$. Since now the labor share $1 - \alpha = \left(w^\ell L^\ell + w^h L^h\right)/Y$, the total effect of additional low-skill immigrant employment on the output of a price-taking firm (2) becomes

$$\frac{dY^*}{dL^*} = w^\ell \cdot \left(1 + \frac{\alpha}{1-\alpha}\right) + w^h \cdot \frac{dL^h}{dL^\ell}\left(1 + \frac{\alpha}{1-\alpha}\right). \tag{8}$$

The new, second term reflects the additional income needed to compensate the high-skill workers who enter the production function alongside the additional low-skill worker, as well as the owners of the capital that those additional high-skill workers use. Net fiscal revenue now allows for different rates of benefits and taxation by skill level, $T \equiv \left(\tau_L^\ell w^\ell - b_L^\ell\right) L^\ell + \left(\tau_L^h w^h - b_L^h\right) L^h + \left(\tau_K r - b_K\right) K$, so that the net fiscal effect of additional low-skill immigrant employment is

$$\frac{dT}{dL^\ell} = \left(1 + \frac{\tau_K}{\tau_L^\ell} \cdot \frac{\alpha}{1-\alpha}\right)\tau_L^\ell \cdot w^\ell - b_L^\ell + \left(\tau_L^h w^h - b_L^h + \tau_K w_h \frac{\alpha}{1-\alpha}\right)\frac{dL^h}{dL^\ell}. \tag{9}$$

The new, last term on the right-hand side is attributable to fiscal revenue from immigrant high-skill workers. It captures net revenue due to taxing labor income of the additional high-skill workers who enter the production function alongside the additional low-skill worker, and due to taxing capital income from the capital that those additional high-skill workers use. Those other fiscal effects should not be included in estimations of the fiscal effect of low-skill workers, or they would be double counted when the fiscal effects of high-skill workers are enumerated. In other words, the effect on net fiscal revenue attributable to the employment of the additional low-skill immigrant worker is simply

$$\frac{dT}{dL^\ell} = \left(1 + \frac{\tau_K}{\tau_L^\ell} \cdot \frac{\alpha}{1-\alpha}\right)\tau_L^\ell \cdot w^\ell - b_L^\ell. \tag{10}$$

Here again, we can arrive at *accounting method* estimates of the "fiscal impact of immigration" for workers at each skill level by assuming either that owners of capital fail to maximize profits ($\alpha = 0$) or that capital income is untaxed ($\tau_K = 0$), so that

$$\frac{dT}{dL^\ell} = \tau_L^\ell \cdot w^\ell - b_L^\ell. \tag{11}$$

The remainder of the paper drops that last, strong assumption and estimates the skill-specific net fiscal effect of additional immigrant employment assuming price-taking, profit-maximizing firms (10).

3 Empirical elements of the adjustment

Implementing the proposed adjustment requires three empirical elements in the equation for net fiscal impact (10): 1) an estimate of the effective rate of taxation on capital relative to labor $\left(\frac{\tau_K}{\tau_L}\right)$ at each education level; 2) an estimate of the capital share of income (α); and 3) an estimate of immigrant workers' labor-income taxes paid and benefits received by level of education $(\tau_L \cdot w - b_L)$. This section discusses how these elements can be used to adjust the leading estimates of the fiscal impact of immigration in the United States, by Blau et al. (2017).

3.1 Effective tax rates on capital versus labor

Saez and Zucman (2019, 93 and Technical Appendix) calculate the effective rate of taxation on labor and capital in the United States in each year 1913–2019. This is not a statutory tax rate, but the ratio of taxes actually collected to factor income, what Saez and Zucman call the "macroeconomic tax rate". Taxes on labor include the labor share of federal, state, and local income taxes and government social contributions; taxes on capital include the capital share of federal, state, and local income taxes as well as corporate income taxes, property taxes, and estate-and-gift taxes.

Over the three years studied by Blau et al., 2011 through 2013, Saez and Zucman estimate that the effective tax rate on capital income was 24.6 percent. On labor income the effective tax rate was 22.7 percent, implying the ratio $\frac{\tau_K}{\tau_L} = 1.081$. Shifting sales tax revenue onto factors of production, the corresponding effective tax rates are 29.4 percent for capital and 27.6 percent for labor, with a ratio $\frac{\tau_K}{\tau_L} = 1.066$. That is, the effective tax rates on capital income and labor income in the United States are comparable in magnitude.

Additional calculations are needed to estimate this ratio for workers at different levels of education in Table 1. This is done by normalizing the individual-level ratio of taxes paid to income at each education level, as a fraction of the ratio for the average worker, and scaling the Saez and Zucman estimate of the overall effective tax rate on labor by that normalized ratio. That is, the ratio of the effective capital tax rate to the effective labor tax rate at each education level e is

Table 1: Estimated effective tax rates on labor by education level, 2011–2013

	Number (000s)	Taxes paid ($)	Income ($)	$\frac{\text{Tax paid}}{\text{Income}}$	Ratio to avg.	Est. τ_L^e	Implied τ_K/τ_L^e
Less than high school	25,277	4,100	25,100	0.163	0.844	0.233	1.262
High school only	62,113	6,400	35,400	0.181	0.934	0.258	1.140
Some college	53,899	7,903	42,011	0.188	0.972	0.268	1.096
Bachelor's	40,561	11,400	56,500	0.202	1.043	0.288	1.022
Postgraduate	22,730	16,739	77,318	0.216	1.119	0.309	0.952
All	204,579	8,652	44,710	0.194	1.000	0.276	1.066

Median tax payments (federal, state, and local; direct and indirect) and median income at each education level for workers age 25+ from Baum et al. (2013, 11). Number of workers at each education level in 2012 from U.S. Bureau of the Census, *Educational Attainment in the United States: 2012*, "Table 2: Educational Attainment of the Population 25 Years and Over, by Selected Characteristics: 2012", accessed Dec. 1, 2021, the same source used by Baum et al. Average effective ('macroeconomic') tax rates of $\tau_L = 0.276$ and $\tau_K = 0.294$ from Saez and Zucman (2019) in 2011–2013 as described in the text. Estimated τ_L for each education group is calculated by taking the ratio of taxes paid to income (col. 4), for each education level and for the average worker, then normalizing that ratio as a fraction of the average (0.194) in col. 5. This normalized ratio is multiplied by the Saez and Zucman estimate of overall τ_L to estimate education-specific τ_L in col. 6. The Saez and Zucman estimate of τ_K is divided by education-specific τ_L in the final column to yield education-specific τ_K/τ_L.

estimated as

$$\frac{\tau_K}{\tau_L^e} = \frac{\tau_K}{\frac{t^e/w^e}{t/w} \cdot \tau_L}, \tag{12}$$

where t^e and w^e are respectively dollars of tax payments and dollars of earnings by the median worker with education e; and t and w are the same quantities for the median worker at any education level. The table shows that the effective ('macroeconomic') tax rate on labor by workers with less than high school is 23.3 percent, lower than the figure for aggregate labor of 27.6 percent. The ratio of the effective capital income tax rate to the effective labor income tax rate is thus higher for workers with less than high school (1.262) than for aggregate labor (1.066).

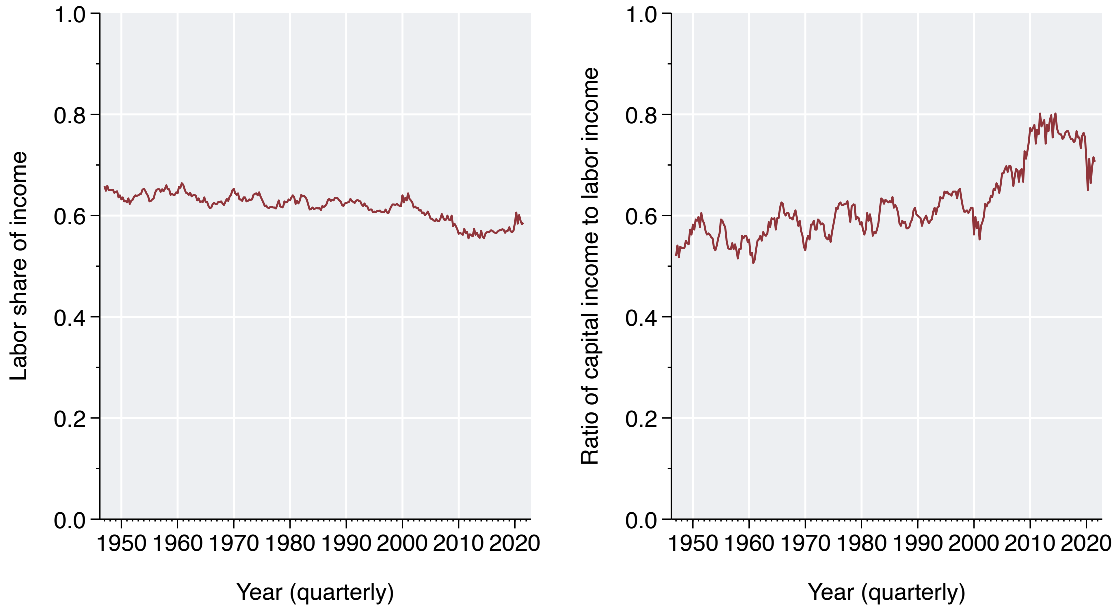
3.2 Shares of national income to labor and capital

The labor share of income in the nonfarm business sector estimated by the Bureau of Labor Statistics has averaged 0.571 during 2015–2020 (BLS 2020b).[9] During the three-year period studed by Blau et al. (2017), 2011 through 2013, the labor share averaged 0.564. It has averaged below 0.65 in every year since 1961, and below 0.60 in every year since 2005 (Figure 1a). While the causes of the more recent, lower estimates of labor share are debated (Gutiérrez and Piton 2020; Stansbury and Summers 2020; Koh et al. 2020; Oberfield and Raval 2021), the fact of low levels of

[9] Average quarterly labor share, 2015Q4 through 2020Q3, for all employed persons in the nonfarm business sector.

Figure 1: Relative factor incomes: United States nonfarm business sector, 1947Q1–2021Q3

(a) *Labor share* (b) *Capital income per dollar labor income*



From BLS (2020b), all employed persons

labor share in recent years is accepted as "general consensus" (Autor et al. 2020, 648).[10] Figure 1b shows the corresponding value of capital income per dollar of labor income $\left(\frac{\alpha}{1-\alpha}\right)$, taxes on which are omitted by the accounting method. It has been above \$0.50 in every quarter on record, and has averaged above \$0.70 for the past 11 years.

These figures imply that an appropriate estimate of capital share in the years considered by Blau et al. (2017) is $\alpha = 0.436$. The nonfarm business sector for which this estimate is calculated excludes any imputed shadow-rental income to the owners of owner-occupied housing (BLS 2020a), which will affect the calculations to follow.

[10] The precise level of the labor share is sensitive to accounting methods. For example, the BLS estimates in Figure 1a count incorporated proprietors' income as labor income, since they are technically employees (Giandrea and Sprague 2017), while Koh et al. (2020) divide incorporated proprietors' income between capital and labor according to the factor shares for other types of income that can be assigned unambiguously. (Both use this latter method to divide *un*incorporated proprietors' income.) The effects of these differences on the level of the labor share are not large. For example (BLS 2020b) estimates the 2016 labor share at 0.56–0.57 while Koh et al. (2020) estimate 0.52–0.53.

3.3 Taxes on immigrants' capital income

The analysis in section 4 relates the fiscal impact of immigration to the tax revenue on immigrants' labor income ($\tau_L \cdot w$). Empirical estimates of that quantity require removing capital taxes paid by immigrants from the Blau et al. (2017) estimates of *total* taxes paid by immigrants. These capital taxes consist of taxes on property and taxes on financial capital.[11]

Property taxes. Immigrants can pay property taxes in two ways: directly, as owners of owner-occupied housing, and indirectly, as renters whose rental payments pay for owners' property taxes. Blau et al. (2017, 545) estimate that both direct and indirect property taxes make up 14 percent of the state and local tax revenue paid by immigrants. This amount must be removed from total taxes paid by immigrants in order to adjust for omitted capital income relative to labor income. But the adjustment (3) uses an estimate of the capital share of income that omits imputed capital income to owners of owner-occupied housing (the amount they would have had to pay to rent the same residence). So after scaling, property taxes paid by immigrant owners of owner-occupied housing must be added back in or it would not be counted at all. That is, tax revenue from immigrants adjusted to omit double-counting of property taxes is

$$\left(1 + \frac{\tau_K}{\tau_L} \cdot \frac{\alpha}{1-\alpha}\right)\left(T - T_P\right) + \phi T_P, \tag{13}$$

where T is total taxes paid by immigrants, T_P is government revenue on all property taxes paid directly or indirectly by immigrants, and ϕ is the share paid directly (by immigrant owners of owner-occupied housing). This share is estimated using the methodology of (Blau et al. 2017, 545) in the Appendix. For immigrants overall during 2011–2013, the share ϕ is 0.674. For immigrants with less than high school education, ϕ is 0.579. Property taxes paid directly or indirectly by immigrants (T_P) can be estimated as $T_P \approx T \cdot s_{\ell,e} \cdot 0.14$, where $s_{\ell,e}$ is the average share of immigrants' taxes paid that are state and local taxes, by education group e, calculated by Blau et al. (2017, 445–450).

Taxes on financial capital. Some immigrant workers are shareholders, creditors, and business proprietors, and thus can be recipients of income from financial capital. If a portion of their taxes

[11] Estate taxes are also nominally part of capital taxes, but they are not reported in the CPS data used by Blau et al. (2017) and thus need not be removed from those estimates.

are paid on capital income—such as directly-paid taxes on realized capital gains or indirectly-paid taxes such as excise taxes on consumption from capital income—then that tax revenue is already counted in estimates of the total taxes paid directly by immigrants and must not be counted twice. Blau et al. (2017, 394, 'Scenario 8') already estimate fiscal impact scenarios that omit directly-paid capital taxes, finding this to have a negligible effect. But this does not account for indirectly-paid capital taxes.

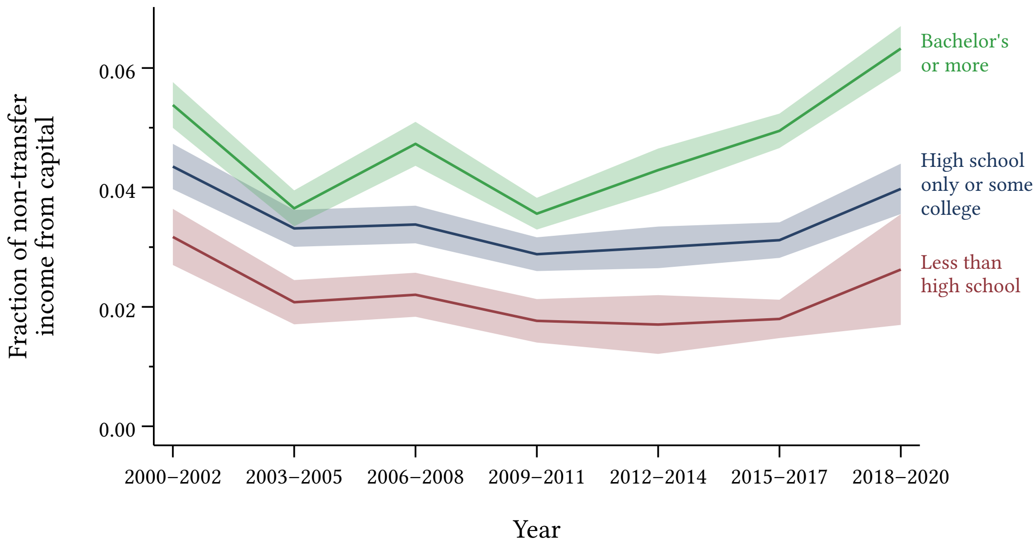
A more conservative method is to remove financial capital income entirely from estimates of immigrants' taxable income. The rest of this section presents estimates of capital income as a fraction of total non-farm, non-transfer income for immigrant workers using the same data source as Blau et al. (2017): the Annual Social and Economic Supplement of the Current Population Survey (CPS, Flood et al. 2020) over the past two decades. For most workers, the classification of capital income and labor income is straightforward. Any income from interest, dividends, rent, or capital gains is counted as capital income. For wage workers, all income from work is counted as labor income. For incorporated self-employed workers, who are considered employees of their own corporation, wage income counts as labor income, as in the CPS and the BLS labor share estimates (Giandrea and Sprague 2017),[12] and any business income in excess of wage income counts as capital income.

For unincorporated self-employed workers, who are about 7% of immigrant workers during this period, the decomposition of income is less clear (Krueger 1999; Gollin 2002). In its national labor share estimates, BLS (2020b) essentially follows the method of Kravis (1959): For unincorporated self-employed workers, BLS imputes an hourly wage estimated from the hourly wage in the employee market, conditional on sector only (Giandrea and Sprague 2017). It then multiplies by observed hours worked to arrive at an annual shadow wage, which counts as labor income. Any business income in excess of this shadow wage is counted as capital income.

For the average foreign-born unincorporated self-employed worker, such a shadow wage predicted by basic determinants of earnings somewhat *exceeds* actual income from work. This estimation is shown in detail in the Appendix, using the same CPS data on all foreign-born work-

[12] "Current Population Survey (CPS) estimates of wage and salary workers include the incorporated self-employed. This is because, technically, the incorporated self-employed are paid employees of their corporation." https://www.bls.gov/cps/definitions.htm#earningswagesalary

Figure 2: Immigrant workers' Capital Income: Upper bounds on the share of annual non-farm, non-transfer income, by education level, 2000–2020



Data on all foreign-born workers in the Current Population Survey, Annual Social and Economic Supplement (Flood et al. 2020), in pooled three-year intervals. Shaded areas show 95 percent confidence intervals on the ratio of total incomes in each subpopulation.

ers 2000–2020. Following ILO (2019), it uses Predictive Mean Matching (Rubin 1986) to estimate shadow wage-worker wage income for observably identical unincorporated self-employed workers (matched on gender, age, education, race, Hispanic classification, world region of birth, and survey year, and using observed hours worked). Actual annual business and wage income for these workers is $33,541, and imputed annual shadow-wage income is $43,380. The aggregate total shadow wage income for this subpopulation, summed across all unincorporated self-employed immigrant workers, is greater than aggregate actual business and wage income by a factor of 1.3 (standard error 0.02). This factor does not fall below 1.16 at any level of education, a result compatible with negative selection on unobserved traits into unincorporated self-employment relative to wage work.[13] It is thus conservative to count unincorporated self-employed immigrants' CPS-reported business income as labor income.

[13]This is compatible with evidence that immigrant workers, especially those without university education, typically earn more in the labor market than in self-employment (e.g. Lofstrom 2013). Negative selection into self-employment on unobserved determinants of earnings can arise from unobserved constraints on labor-market matching such as limited social networks (Kerr and Mandorff 2021), unrecognized experience/qualifications, or lack of legal authorization for formal employment.

This allows straightforward estimates of capital income as a fraction of immigrants' overall non-farm, non-transfer income, shown in Figure 2. The denominator is all non-farm, non-transfer income reported by each foreign-born person, including both labor and capital income. The numerator is reported capital income: from interest, dividends, rent, and business income for the incorporated self-employed.[14]

During the period 2011–2013 studied by Blau et al. (2017), this financial capital income share for immigrants overall is 0.0291, and for immigrants with less than a high school degree it is 0.0163 (detailed results in the Appendix).[15]

Combining this with equation (13) gives an expression for corrected tax revenue per immigrant that omits double counting of tax revenue from taxes on property or on income from financial capital:

$$\left(1 + \frac{\tau_K}{\tau_L^e} \cdot \frac{\alpha}{1-\alpha}\right)\left(1 - \theta^e\right)\left((1 - 0.14 s_\ell^e) \cdot T^e\right) + \phi^e \cdot 0.14 \cdot s_\ell^e \cdot T^e, \tag{14}$$

where T^e is total taxes paid by immigrants at education level e, θ^e is the average fraction of nontransfer income from income on financial capital for immigrants of education e, and total tax revenue on immigrants' labor income $(\tau_L \cdot w)$ is given by the term $\left(1-\theta^e\right)\left((1-0.14 s_\ell^e) \cdot T^e\right)$. Equation (14) implements equation (3) using the data available.

[14] The denominator is the sum of capital income, wage/salary income, and business income, for the reasons discussed above. The conceptual definition of capital income is that used by Donovan et al. (2016, 18): interest, dividends, rent, and capital gains, augmented to include incorporated self-employed workers' business income in excess of their wage income. Though the 2019 and 2020 rounds of the survey also include a line for income from capital gains, it is omitted here because it is unavailable for most years and because, for the most relevant case of workers with less than high school, it is minuscule. In 2020, for example, including capital gains income for those without a high school degree in Figure 2 raises the capital fraction of income from 0.0273 to 0.0276. At higher levels of education the omission of capital gains is somewhat more important: For those with a bachelor's degree or more, the 2020 ratio excluding capital gains is 0.721 and including capital gains it is 0.0854. Unincorporated self-employed workers' business income is counted as labor income because their total income from work (business and wage income) is less than their shadow wage in the labor market.

[15] The estimated capital shares in Figure 2 should be interpreted as upper bounds. This is because the survey respondents are not asked about an important portion of labor compensation: non-wage benefits such as employer-provided health insurance. These are included in the BLS labor share estimates above. If non-wage benefits were included in Figure 2, to make them more comparable with the BLS labor share, all estimated capital shares would fall below the values shown.

4 Empirical estimates for the United States

The above tools allow adjustment of partial-equilibrium accounting estimates of immigrants' net direct fiscal contribution (4) into partial-equilibrium estimates of the net fiscal impact of immigration (3). The starting point is the best existing accounting-method estimates of the fiscal impact of U.S. immigration.

4.1 Unadjusted estimates using the accounting method

Blau et al. (2017, 445–7) estimate the lifetime present value of recent U.S. immigrants' taxes paid and benefits received by level of education, at all levels of government. They account for a comprehensive range of federal, state, and local benefits received by immigrants. These include Social Security, Medicare, Medicaid, unemployment benefits, Earned Income Tax Credit, Aid to Families with Dependent Children, Temporary Assistance for Needy Families, prison costs, refugee resettlement credits, public housing, rent subsidies, worker's compensation, local policing, and many others.

They estimate scenarios both with and without long-term changes in budget policy projected by the Congressional Budget Office (2014), such as future changes in the Social Security retirement age, and scenarios both with and without including immigrants' descendants. Uncommonly, the estimates account for immigrants' effects on congestible local public services including children's schooling costs, other local public administration expenses, police and fire-fighting services, and incarceration services.[16]

4.2 Adjusting for omitted capital tax revenue

The above estimates can now be adjusted with equation (14). This uses the above estimates of immigrants' share of income from financial capital (θ), their share of property taxes paid directly on owner-occupied housing (ϕ), and their share of all taxes paid that are state and local taxes rather than federal (s_ℓ).

[16]The estimates omit government revenue from immigrants in the form of fees (Blau et al. 2017, 391), such as visa application and processing fees. If such fees are set for cost recovery only, this omission does not contribute to bias.

Table 2: Fiscal Flows from and to U.S. Immigrants: 75-year present value flows for consolidated federal, state, and local governments, thousands of 2012 dollars

	Immigrants only			Immigrants and descendants		
	Taxes	Benefits	*Diff.*	Taxes	Benefits	*Diff.*
Including already-legislated future changes to fiscal policy						
Less than high school	272	381	−109	503	619	−116
High school only	365	354	11	620	570	50
Some college	491	336	155	844	583	261
Bachelor's	649	319	330	1005	524	481
Postgraduate	939	304	635	1314	503	811
Average	*515*	*342*	*173*	*822*	*563*	*259*
Excluding all changes to fiscal policy						
Less than high school	213	328	−115	349	534	−185
High school only	282	311	−29	432	499	−67
Some college	372	293	79	576	509	67
Bachelor's	493	283	210	697	462	235
Postgraduate	695	268	427	909	440	469
Average	*391*	*299*	*92*	*569*	*491*	*78*

Reproduced from Blau et al. (2017, 445–7). Present values discounted at 3 percent, estimated over a 75-year period following arrival of a new immigrant of the average age within each educational group, starting at age 25. Descendants include children and grandchildren. *Average* row weighted by proportion of recent immigrants in each education category. Underlying data from the Current Population Survey 2011–2013, including only recent immigrants (arrived within the previous five years). Projections of fiscal policy including already-legislated future changes to policy are from Congressional Budget Office (2014).

The results of this adjustment are shown in Table 3. The first two columns give the estimates for θ and ϕ calculated above. The next four columns calculate, stepwise, the fiscal impact of one recent immigrant at each education level—without descendants. The first of these columns shows the state-local fraction of all taxes paid by immigrants (s_ℓ), from Blau et al. (2017). The next gives labor tax revenue, that is, the tax revenue that remains after eliminating property taxes and taxes on financial capital income ($\tau_L \cdot w$). The next column presents the implied value of total tax revenue by equation (14), at capital share $\alpha = 0.436$ and using the tax ratios $\frac{\tau_K}{\tau_L^e}$ from Table 1. The next column subtracts from this the benefits received (from Table 2) to show the implied net fiscal impact per recent immigrant. The final four columns repeat this exercise to include fiscal impacts of both the immigrants themselves and their next two generations of descendants.

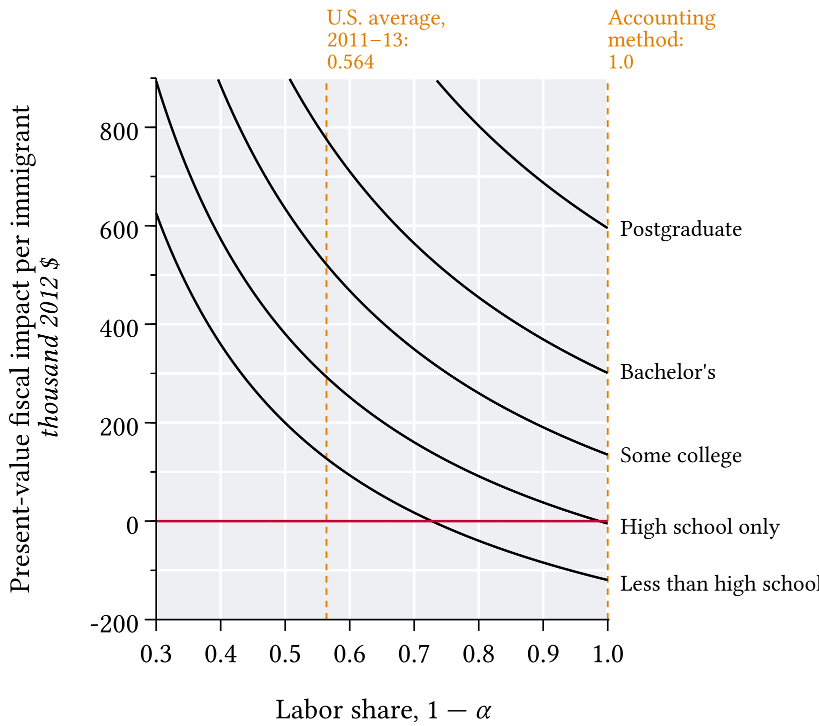
The estimates of net fiscal impact are positive at all education levels, both for immigrants as individuals and for immigrant families including children and grandchildren. The adjusted estimates

Table 3: Net Fiscal Flows Caused by Presence of the Average Recent Immigrant: 75-year present value flows for consolidated federal, state, and local governments, thousands of 2012 dollars

			Immigrants only				Immigrants and descendants			
	θ	ϕ	s_ℓ	Taxes on labor inc. $(\tau_L \cdot w)$	Tax revenue impact	Net fiscal impact	s_ℓ	Taxes on labor inc. $(\tau_L \cdot w)$	Tax revenue impact	Net fiscal impact
Including already-legislated future changes to fiscal policy										
Less than high school	0.0163	0.579	0.382	253	509	128	0.336	472	945	326
High school only	0.0249	0.617	0.353	338	648	294	0.318	578	1104	534
Some college	0.0271	0.680	0.324	456	857	521	0.294	787	1478	895
Bachelor's	0.0345	0.705	0.297	601	1094	775	0.280	932	1696	1172
Postgraduate	0.0335	0.718	0.267	874	1542	1238	0.259	1224	2159	1656
Average	0.0291	0.674	0.313	478	887	545	0.292	765	1419	856
Excluding all changes to fiscal policy										
Less than high school	0.0163	0.579	0.432	197	396	68	0.407	324	651	117
High school only	0.0249	0.617	0.408	259	498	187	0.389	398	764	265
Some college	0.0271	0.680	0.382	343	646	353	0.366	532	1002	493
Bachelor's	0.0345	0.705	0.353	452	827	544	0.346	640	1170	708
Postgraduate	0.0335	0.718	0.324	641	1136	868	0.323	839	1486	1046
Average	0.0291	0.674	0.368	360	670	371	0.360	525	976	485

Unadjusted values use equation (4), adjusted values use equation (14), using labor share $1 - \alpha = 0.571$ for 2011–2013. Direct taxes and benefits from Blau et al. (2017, 445–7). Present values discounted at 3 percent, estimated over a 75-year period following arrival of a new immigrant of the average age within each educational group, starting at age 25. Descendants include children and grandchildren. *Average* row weighted by proportion of recent immigrants in each education category. Underlying data from the Current Population Survey 2011–2013, including only recent immigrants (arrived within the previous five years). Projections of fiscal policy including already-legislated future changes to policy are from Congressional Budget Office (2014).

Figure 3: Lower Bounds on Fiscal Impact by Education and Labor Share: 75-year present value flows at all levels of government, without immigrants' descendants



The curves graph equation (14) using the taxes paid and benefits received for each education group from Blau et al. (2017, 445) in Table 2 and using the education-specific effective tax rate ratios in Table 1. Shown are the values for recent immigrants (arrived 0–4 years ago), omitting descendants, including already-legislated future changes to fiscal policy. The curves are lower bounds because they assume zero impact of immigrants' descendants.

imply that the presence of a recent U.S. immigrant without a high school degree causes a net present value increase in tax revenue of $509,000, about 2/5 of which is tax revenue on capital income that is a necessary condition for the immigrant's wages to exist. Because the average recent immigrant without a high school degree causes a lifetime increase of $381,000 in public benefits expenditures (Table 2), such an immigrant causes a lifetime positive net fiscal balance of $128,000. The corresponding estimate by Blau et al. (2017), omitting capital tax revenue, is −$109,000. That is, the bias induced by assuming a capital share of zero in equation (3) is sufficient to change the sign of the net impact. Including the expected children and grandchildren of the average immigrant without a high school degree, the lifetime positive net fiscal effect is $326,000.

4.3 Alternative assumptions on labor share

The above estimates depend most critically on the assumed capital share of income (α) and corresponding labor share $(1 - \alpha)$. Figure 3 graphs the relationship between net tax revenue per immigrant (10) corrected to eliminate double-counting of capital taxation (14). It shows how the above calculation would differ by education group under different assumptions about the labor share of national income.

Estimates using the accounting method, which assumes a labor share of one, are shown at the right edge of the graph. These are the present-value net fiscal flows in Blau et al. (2017, 445). If the true labor share is the share observed over the past five years (0.564), estimates using the accounting method are severely biased. For the less-than-high-school group, the estimated fiscal impact has the wrong sign. A negative impact requires values of the labor share over 0.72, higher than ever observed in the last 73 years (Figure 1a). That is, the positive sign on fiscal impact at all education levels in Table 3 is robust to all values of the labor share observed in modern history.

5 Extensions and robustness

The empirics above rely on several assumptions. This section explores the empirical support for those assumptions and the consequences of relaxing them.

5.1 Accounting for displacement from overall employment

The analysis above considers the change in net fiscal revenue caused by the employment of one additional worker at the margin. If the *admission* of an immigrant worker causes employment to rise by one worker, the estimates above can also be interpreted as the impact of admitting that immigrant worker.

But in principle the admission of an immigrant worker could indirectly cause employment for other workers (native or immigrant) to rise or fall, so that the marginal admitted immigrant worker does not raise the number of employed workers one-for-one. This could affect the fiscal impact estimates in two ways. First, if immigrant employment has the net effect of reducing native employment, this could reduce tax revenue from native workers. Second, it could raise public expenditures on benefits to natives, such as unemployment insurance.

By various mechanisms, the marginal immigrant worker can tend to raise the employment of incumbent workers. Immigrant workers purchase additional goods and services requiring additional employment of incumbent workers (Howard 2020; Peri et al. 2020). Immigrant workers start businesses that cause additional employment, including in small businesses (Azoulay et al. 2020), and some types of immigrants cause firms to hire additional nonimmigrant workers (Mayda et al. 2020). Immigrants producing services that support native labor force participation, such as care workers, can raise native employment (Cortes and Tessada 2011). Effects of this kind tend to give equation (3) a negative bias as an estimator for immigrants' net fiscal effect.

The marginal immigrant worker can also tend to raise unemployment or reduce employment for incumbent workers who would otherwise have been hired, if they do not find alternative jobs or leave the labor force altogether. The empirical literature as a whole fails to find systematic, substantial effects of this kind. Meta-analyses by Longhi et al. (2008, 2010) find that published empirical estimates of the effect of immigration on both the unemployment rate and the employed fraction of the working age population cluster tightly around zero. These estimates are even smaller in the United States than in Europe and elsewhere (Longhi et al. 2008, 181). In the United States, studies of large and plausibly exogenous inflows of immigrants to specific metropolitan areas do not find a detectable rise in native unemployment, even in the short term (Card 1990; Card and DiNardo 2000; Borjas and Monras 2017; Peri et al. 2020; Monras 2020, 3042), and immigrants with the lowest education and wages may reduce native unemployment at the metropolitan-area level (Albert 2021). Higher state-level immigration is associated with higher native employment (Peri 2012) and a higher probability that unemployed workers transition to employment (Rios-Avila and Canavire-Bacarreza 2020). Historically, large policy-induced reductions in U.S. immigration have caused no detectable rise in native employment (Clemens et al. 2018; Abramitzky et al. 2019; Mayda et al. 2020).

Studies have reached similar conclusions in the United Kingdom (Dustmann et al. 2005), Canada (Islam 2007), Australia (AboElsoud et al. 2020), and Germany (Pischke and Velling 1997; Felbermayr et al. 2010). Substantial displacement of incumbents from employment is found in exceptional settings, such as when the affected workers are teenagers (Smith 2012), or when the arriving workers are returning ethnic nationals (Glitz 2012; Braun and Mahmoud 2014) or non-resident day workers (Dustmann et al. 2016a).[17] Collectively, the empirical literature is consistent with the assumption that the admission of one immigrant worker raises employment by roughly one or more, particularly in the United States.

5.2 Accounting for relative price effects on heterogeneous labor

The preceding analysis assumes that all types of labor are perfect substitutes in production, and notes the lack of evidence for lasting effects of immigration on the relative price of capital and labor overall. But the literature has documented that immigration has heterogeneous effects on the price of different types of labor, particularly by education level (Ottaviano and Peri 2012; Dustmann et al. 2016b; Llull 2018; Busch et al. 2020). Such distributional effects can persist in the long term due to constraints on educational investment by most adults and some children.

A fuller analysis would consider the effects of immigration on different types of labor that are imperfect substitutes. Colas and Sachs (2020) point out that any such distributional effects would tend to produce a positive shift in the effect of low-education immigration on labor tax revenue. This arises if immigration raises the *relative* wages of high- versus low-education workers. Workers with high education 1) receive relatively higher earnings at higher marginal tax rates, and 2) are more numerous than subgroups with the least positive or even negative wage effects, such as those with less than high school education. Thus the additional tax revenue from raising wages for those with higher marginal tax rates exceeds the smaller gain (or loss) from wage effects on those with lower marginal tax rates. This effect would be even more pronounced if immigration causes natives to acquire education (Hunt 2017; Llull 2018), that is, raising not just the earnings of natives with high education and high marginal tax rates but raising the number of natives in that category.

[17] An exception in recent work is Edo (2015), who finds the immigrants substantially displace workers from employment in France, a country with unusually rigid labor-market institutions, using the national skill-cell method criticized by Dustmann et al. (2016b, 44) and by Card and Peri (2016, 1337–1339).

5.3 Accounting for immigrant-specific labor share

The preceding analysis assumed that workers' power to negotiate the labor share of income is identical for immigrants and natives. This may be somewhat unrealistic, for two reasons. First, employers' monopsony power over immigrants supplying labor might exceed their power over natives, across all industries. Second, immigrants may concentrate for historical or other reasons in different industries than natives, and different industries exhibit different labor shares.

Recent evidence in labor economics is consistent with Joan Robinson's (1933, 292) idea that workers may not frictionlessly separate if a firm marginally reduces its wage, represented by a finite elasticity of labor supply. The firm's resulting monopsony power places a wedge between the wage and marginal product (Ashenfelter et al. 2010; Manning 2021; Card 2022). If the wage elasticity of labor supply is ε, the labor-share and capital-share identities require $\frac{K^*}{L^*} = \frac{1+\varepsilon}{\varepsilon} \cdot \frac{\alpha}{1-\alpha} \cdot \frac{w}{r}$ (Naidu et al. 2018; Hershbein et al. 2021), so that the constant-price fiscal effect (3) becomes

$$\frac{dT}{dL} \gtrless \left(1 + \frac{1+\varepsilon}{\varepsilon} \frac{\alpha}{1-\alpha}\right) \cdot \tau_L w - b_L. \tag{15}$$

In other words, the observed labor share for workers overall is now a function of both α and ε. If immigrants in the labor market face firms with greater monopsony power than average workers (ε is lower), then immigrants' labor share is lower than the values in Figure 1a, and capital tax revenue per dollar of labor tax revenue from immigrants is higher than the values in Figure 1b.

Recent empirical results suggest that in fact the resulting wedge between wage and marginal product is relatively larger for foreign-born workers (Qiu and Sojourner 2019). It is also larger for less educated workers (Qiu and Sojourner 2019; Tortarolo and Zarate 2018) and, relatedly, for low-paid workers (Bassier et al. 2021).[18] This implies that in particular the labor share of less-educated immigrant workers would fall below the recent aggregate labor share of 0.56–0.60 in Figure 1a. This would tend to give equation (3) a negative bias as an estimator for the true net fiscal effect, even for the least-educated immigrants.

[18] Bassier et al. (2021, 51, Table 6) find that the ratio of wages to marginal revenue product is 0.74 in the bottom quartile of earnings and 0.82 in the top quartile, given that firm-labor supply elasticity $e = -2 \times$ separation elasticity, and $\frac{\text{wage}}{\text{MPL}} = \frac{e}{1+e}$. Arin Dube pointed out the relevance of this markdown estimate.

Alternatively, the labor share of immigrant workers could in principle exceed the labor share of natives if immigrants concentrate in industries with high labor share. The Appendix calculates the average labor share of value added across U.S. industries, weighted by the distribution of workers, both for workers in general and for immigrant workers specifically. The cross-industry average labor share of value added is slightly lower when weighted by the distribution of immigrant workers (0.624) than when weighted by the distribution of all workers (0.628). This is inconsistent with any systematic concentration of foreign-born workers in industries with a relatively high labor share.

5.4 Accounting for public goods

The estimated benefits in Table 2 omit nonrival, nonexcludable goods such as national defense, foreign aid, and fixed costs of government operation. That is, equation (3) implicitly assumes that the marginal immigrant's arrival has no effect on the cost of public benefits provided to natives. This is appropriate, since for such public goods, "the marginal cost of an additional immigrant is, at least in the short run, zero or close to it" (Blau et al. 2017, 8). But even if such government expenditures were allocated on a per-capita basis as congestible 'benefits' to immigrants, their ratio of taxes directly paid to benefits received would still meet the condition for positive fiscal impact in equation Figure 3 at all levels of education. For example, under Congressional Budget Office projections of already-legislated fiscal policy, the ratio would become 0.633 for immigrants themselves and 0.716 including their descendants (Blau et al. 2017, 454). None of the best recent estimates of the labor share exceed these values.[19]

5.5 Accounting for political economy effects

The preceding analysis assumed that the marginal immigrant does not affect society's payments of government benefits to workers $\left(\frac{db_L}{dL} \equiv 0\right)$. Some such effects would make the preceding

[19]The estimates similarly exclude interest payments on public debt. This is appropriate, because the marginal immigrant does not affect public debt other than through his or her own net fiscal impact. As Blau et al. (2017, 410) note, "Interest payments are conceptually distinct from spending on public goods; they represent the current costs of servicing past deficits that have accumulated into the current debt. New immigrants are responsible only for the net fiscal impacts incurred once they have arrived in the country." In the model of Storesletten (2000), immigrants do affect interest payments by raising the return on capital and thus the price of borrowing, but this result requires abstracting away from the ability of the U.S. to borrow capital from abroad.

estimates of positive fiscal impact conservatively low, such as if admitting immigrants with a certain training reduces the need to subsidize natives for acquiring that training. But if additional immigrants increase support for more income redistribution and more generous public benefits, this would have a negative effect on the net fiscal impact of an additional immigrant.

The literature on political economy effects of this kind rather suggests the opposite effect. Social diversity increased by immigration may reduce the willingness of natives to redistribute income (Facchini et al. 2004; Alesina et al. 2018; Moriconi et al. 2019; Giuliano 2021; Alesina et al. 2021), all else equal. This effect appears to typically dominate any countervailing effect of increased social transfers to mitigate labor market risks associated with immigration (surveyed by Elsner and Concannon 2021).

Immigration could raise public expenditures or reduce public income by other political economy mechanisms. In principle, immigration could raise crime rates, resulting in increased public expenditures on policing and incarceration. Ousey and Kubrin (2018) review the criminology literature and conclude that "overall, the immigration-crime association is negative—but very weak". This finding is independent of immigrants' legal status (Light and Miller 2018; Gunadi 2020; Light et al. 2020). Immigration could also, in principle, have the long-term effect of eroding social capital in homogeneous societies, reducing trust and thereby implicit contract enforcement, and thus reducing both economic productivity and public revenue. The literature has failed to find substantial effects of this kind (Clemens and Pritchett 2019). On the contrary, greater birthplace diversity is positively associated with increased national-level productivity (Alesina et al. 2016).

6 The Disanalogy with Tax Scoring

At first glance, the methodological debate addressed here seems to recapitulate another, related debate in public finance. The literature on fiscal effects of immigration has evolved as an extension of the literature on 'scoring' the net fiscal effects of changes in tax policy. The two literatures have used similar methods—static or dynamic accounting for direct cash flows, and general equilibrium modeling (Auerbach 1996; Auerbach and Oreopoulos 2000).

In both literatures, there have been similar concerns that accounting for only the direct cashflow effects of a tax policy change can omit general equilibrium effects (Auerbach 2005), favoring precision at the cost of bias. "Although it is hard to estimate the impact of a tax cut on output, we know that it is not likely to be zero," said Mankiw (2003), critiquing that "precise but wrong answer." Policy analysis of fiscal effects in tax scoring, as in immigration, often falls back on straightforward cashflow accounting. General equilibrium effects of tax changes are sufficiently sensitive to assumptions (Mankiw and Weinzierl 2006; Leeper and Yang 2008) that even the most serious modeling attempts may "do more harm than good" (Gravelle 2014, 30).

But these two problems of measurement are not as analogous as they appear. The problem in the accounting approach pointed out by this paper for studies of immigration policy does not arise for tax policy. Thus the critique made here for fiscal accounting of immigration does not recapitulate general-equilibrium critiques in the tax-scoring literature. To see this, consider the effect on net tax revenue from a change in the tax rate on labor income, in the framework of subsection 2.2:

$$\frac{dT}{d\tau_L} = wL + \tau_L \frac{dw}{d\tau_L}\left(L + w\frac{dL}{dw}\right) + \tau_K \frac{dr}{d\tau_L}\left(K + r\frac{dK}{dr}\right). \tag{16}$$

This total effect consists exclusively of a direct effect on cashflows paid by those on whom the tax is incident (wL) and general equilibrium effects of the tax change via factor prices (the other two terms on the right side). Here there is no separate static effect—that is, without price adjustment—analogous to the static term $\frac{\tau_K}{\tau_L} \cdot \frac{\alpha}{1-\alpha}$ in equation (3). To study the fiscal effect of this tax policy change (16) at partial equilibrium, in the absence of price adjustment $\left(\frac{dw}{d\tau_L} = \frac{dr}{d\tau_L} = 0\right)$, it is sufficient to account for changes to direct cash flows alone.

The same is not true of immigration. A shift in tax policy changes the cash flows to or from a worker, but a shift in immigration policy changes whether or not that worker participates in the economy in the first place. If anyone else in the economy profits from that worker's participation, and such profits are taxed, the removal of that worker has effects on overall tax revenue that go beyond taxes paid by the worker. Those other effects are immediate, do not depend on general equilibrium price adjustment, and have no analog in the literature on tax scoring.

7 Implications

This analysis suggests that influential, partial-equilibrium estimates of the fiscal impact of skill-selective immigration are severely biased if firms are profit-maximizing. A conservative adjustment to account for this bias changes net fiscal impacts by an order of magnitude in some skill categories, or even changes their sign. The adjusted net fiscal impact is large and positive for all education groups, and more so when immigrants' descendants are accounted for.

The adjustment does nothing to alter the qualitative conclusion of Blau et al. (2017) and many others that the partial-equilibrium net fiscal impact of immigration rises with the level of education. That is, all else equal, there is a larger net positive fiscal effect from admitting a highly-educated immigrant than a low-education immigrant at the margin. But the adjusted estimates of net impact have a much shallower skill gradient. For example, without the adjustment, the partial-equilibrium positive net fiscal impact of an average recent immigrant is 30 times larger if the immigrant has a bachelor's degree rather than high school only (Table 2). After the adjustment, the same ratio is 2.6 (Table 3). And the adjustment does reverse the qualitative conclusion that average recent immigrants without a high school degree impose a net fiscal burden on taxpayers. At partial equilibrium their presence in the workforce, like that of immigrants at other education levels, causes a net subsidy to other taxpayers.

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Online Appendix

"The Fiscal Effect of Immigration: Reducing Bias in Influential Estimates"

Michael A. Clemens — September 2022

A1 Shadow wage estimation for the unincorporated self-employed

Shadow annual wage income for the unincorporated self-employed is estimated as follows. The analysis starts with all foreign-born workers in the pooled 2000–2020 Current Population Survey, Annual Social and Economic Supplement (Flood et al. 2020). Income reported as missing is assumed zero. A set of individual-level indicator variables is generated: gender, age (0–9, 10–19, 20–29, 30–39, 40–49. 50–59, 60–69, 70–79, 80+), education (less than high school, high school only, some college, bachelor's, postgraduate), race (White, Black, Amerindian, Asian/Pacific Islander, Other and Unknown), Hispanic, world region of birth (Mexico and Central America/Caribbean; South America; Europe (West and East including Russia); Asia and Middle East; Africa; Oceania/Pacific).

For wage workers, a log hourly wage is estimated from total hours worked per week assuming 50 weeks of work per year. This wage and the above indicator variables are used to impute shadow wage income for unincorporated self-employed workers, separately by survey year, via two methods: regression, and predictive mean matching (Rubin 1986, 20 nearest neighbors). This hourly shadow wage is combined with actual hours of work per week to impute annual shadow wage earnings for the unincorporated self-employed.

Table A1 compares this shadow wage income with total work income (business and wage) for the population of foreign-born, unincorporated self-employed workers. The imputed wage estimates what the labor-market earnings of the unincorporated self-employed would be if they had the same gender, age, education, race, Hispanic classification, and region-of-origin of workers who are not self-employed. The first three rows of the table indicate that foreign-born, unincorporated self-employed workers, if their unobservable determinants of income were identical to observably identical foreign-born wage-workers, would have substantially higher earnings, on the order of $10,000–13,000 depending on the imputation method. This is compatible with negative selection on unobserved determinants of earnings into unincorporated self-employment with respect to the employee market.

The last five rows of table Table A1 estimate the ratio of actual *aggregate* total work income (business and wage) to imputed *aggregate* total shadow wage income, where these aggregates are summed across all foreign-born unincorporated self-employed individuals in the population. Regardless of education level or imputation method, these ratios fall in the range 1.2–1.5 and are highly statistically precise. Again, this is compatible with negative selection on unobserved determinants of earnings into unincorporated self-employment with respect to the employee market.

A2 Labor share of value added by industry

Table A2 juxtaposes the labor share of value added by industry with the distribution of workers across industries, comparing workers in general to immigrant workers specifically. It shows the percent of all workers, and all foreign-born workers working in each industry in the pooled American Community Survey data 2015–2019 (U.S. Bureau of the Census, "Selected Characteristics of the Native and Foreign-Born Populations", https://data.census.gov/cedsci/table?q=ACSST5Y2016.S0501&g=0100000US&tid=ACSST5Y2019.

Appendix Table A1: Imputing Shadow Wage for the Unincorporated Self-Employed: Current Population Survey ASEC, 2000–2020 pooled

Imputation method:	Regression		Predictive mean matching	
	Estimate	s.e.	Estimate	s.e.
Individual-level average income for unincorporated self-employed				
y (actual: business and wage)	33,541	(444)	33,541	(444)
$\tilde{y}$ (imputed wage income)	46,106	(464)	43,380	(462)
$y - \tilde{y}$	12,565	(598)	9,840	(591)
Aggregate income ratio $\sum y_{\text{actual}} / \sum y_{\text{imputed}}$				
Less than high school	1.34	(0.0382)	1.24	(0.0367)
High school only	1.34	(0.0292)	1.27	(0.0348)
Some college	1.45	(0.0494)	1.31	(0.0417)
Bachelor's	1.53	(0.0571)	1.46	(0.0519)
Postgraduate	1.21	(0.0530)	1.16	(0.0517)
All education groups	1.37	(0.0213)	1.29	(0.0203)

Pooled data on foreign-born workers Current Population Survey, Annual Social and Economic Supplement (Flood et al. 2020), 2000–2020. For unincorporated self-employed workers with nonzero earnings, N = 23,455. Shadow wage income is imputed using wage-workers' wage earnings predicted by gender, age (10 year categories), education (5 categories), race (5 categories), Hispanic, and world region of birth (6 categories). Predictive mean matching uses 20 nearest neighbors. Aggregate income represents the total dollars of such income in the subpopulation, summed across individuals.

S0501, accessed January 5, 2021), and 2019 compensation of employees as a share of value added in all U.S. industries, in the *Industry Accounts* of the U.S. Dept. of Commerce, Bureau of Economic Analysis, revised Dec. 22, 2020 (at https://apps.bea.gov/iTable/index_industry_gdpindy.cfm, accessed January 5, 2021). The last row of the table calculates the average labor share across industries, weighted by the distribution of workers. This weighted average labor share is (barely) lower for foreign-born workers than for average workers.

A3 National income shares by education

Income shares by education are from the Bureau of the Census, *Historical Income Tables: People*, "Table P-18. Educational Attainment—People 25 Years Old and Over by Mean Income and Sex", https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-income-people.html, accessed Nov. 30, 2021. The 2013 estimates use a mix of the redesigned CPS ASEC income questions and those used in previous years. Mean income for all persons in each of the five education categories in the main text is calculated using population-weighted average of the mean income disaggregated by finer education category and by gender in the original source.

A4 Direct vs. indirect property taxes

Blau et al. (2017, 545) estimate both direct and indirect property taxes paid by immigrant households. Direct property taxes are those paid by owners occupying a residence (CPS variable *proptax*). Indirect

Appendix Table A2: Labor Share of Value Added by Industry: 2019

Industry	Labor share	Worker distribution (%) *All workers*	*Foreign-born*
Agriculture, forestry, fishing and hunting, and mining	0.329	1.8	2.4
Construction	0.664	6.6	9.5
Manufacturing	0.482	10.1	11.1
Wholesale trade	0.443	2.6	2.6
Retail trade	0.560	11.2	9.1
Transportation and warehousing, and utilities	0.587	5.4	5.6
Information	0.354	2.0	1.6
Finance and insurance, and real estate and rental and leasing	0.224	6.6	5.4
Professional, scientific, and management, and admin. and waste mgmt. services	0.726	11.6	13.4
Educational services, and health care and social assistance	0.812	23.1	19.5
Arts, entertainment, and recreation, and accommodation and food services	0.600	9.7	11.2
Other services (except public admin.)	0.730	4.9	6.1
Public administration	0.790	4.6	2.4
Average labor share weighted by worker distribution		0.628	0.624

Compensation of employees as a share of value added by industry for 2019 from the U.S. Dept. of Commerce, Bureau of Economic Analysis *Industry Accounts*. Distributions of all workers and foreign-born workers across industries from pooled American Community Survey data 2015–2019.

property taxes are those passed on to renters by owners. This analysis follows Blau et al.: "Property tax assigned to renters (CPS *ownershp* indicator for paying with cash rent) using the state average of property tax as a percentage of household income for owners from the CPS; property tax set to zero for renters if household income is less than or equal to zero." This allows estimation of the fraction of all immigrant households' collective property taxes (direct and indirect) that are direct. This fraction is shown in Table A3, broken down by education level—assigned as the highest level of education completed by any worker in the household.

A5 Taxes on financial capital paid directly by immigrants

Table A4 presents estimates of taxes on financial capital paid directly by immigrants as a fraction of their total nontransfer income, on average during 2011–2013.

Appendix Table A3: Property Taxes: Fraction of immigrants' direct and indirect property taxes paid directly on owner-occupied property

Education group:	Fraction
Less than high school	0.579
High school only	0.617
Some college	0.680
Bachelor's	0.705
Postgraduate	0.718
All education levels	0.674

CPS ASEC 2011–2013 pooled. Fraction is calculated at the household level with household weights, education is the highest education level of any worker in the household.

Appendix Table A4: Taxes on Financial Capital: Fraction of immigrants' nontransfer income by education level, 2011–2013

Education group:	Fraction	std. err
Less than high school	0.01635	(0.00203)
High school only	0.02488	(0.00200)
Some college	0.02707	(0.00201)
Bachelor's	0.03454	(0.00190)
Postgraduate	0.03352	(0.00179)
All education levels	0.02911	(0.00089)

CPS ASEC 2011–2013 pooled. Fraction is calculated at the household level with household weights, education is the highest education level of any worker in the household.