

# Appendix to Attitudes Towards Highly Skilled and Low Skilled Immigration: Evidence from a Survey Experiment: Formal Derivation of the Predictions of the Labor Market Competition Model and the Fiscal Burden Model

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## ABSTRACT

In this online appendix we formally derive the predictions of the labour market competition model and the fiscal burden model.

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## APPENDIX C: THEORETICAL FRAMEWORK

We incorporate a simple model of public finance with the standard factor-proportions (FP) analysis of immigration to derive the basic propositions about natives' attitudes towards highly skilled and low skilled immigrants. We build on similar analysis by Dustman and Preston (2006) and Facchini and Mayda (2007), and where possible use matching notation. Assume a nondiversified economy producing one commodity, with constant returns to scale, using two factors of production: highly skilled labor ( $L_S$ ) and low skilled labor ( $L_U$ ). The native population is made up of  $N = L_S + L_U$  individuals, each owning one unit of labor (either highly skilled or low skilled) and an endowment  $e^n$  of the commodity (where  $n$  indexes natives). Equilibrium is described by full employment of each factor and competitive profits:

$$a_S Q = L_S \tag{1}$$

$$a_U Q = L_U \tag{2}$$

$$a_S w_S + a_U w_U = 1 \tag{3}$$

where  $a_S$  and  $a_U$  are the quantities of each factor required per unit of output  $Q$ ,  $w_S$  and  $w_U$  are wages for highly skilled and low skilled labor, and the commodity price is fixed in the world market and normalized to 1. After total differentiation, given cost minimizing values for  $a_S$  and  $a_U$ , we can derive solutions that express changes in wages as a function of different types of immigration:

$$\hat{w}_S = \frac{(1 - \theta_S)}{\sigma} (\hat{L}_U - \hat{L}_S) \tag{4}$$

$$\hat{w}_U = -\frac{(1 - \theta_U)}{\sigma} (\hat{L}_U - \hat{L}_S) \tag{5}$$

where hats indicate proportional changes,  $\theta_j$  is the distributive share of  $L_j$  in total output ( $j \in \{S, U\}$ ), and  $\sigma$  is the elasticity of substitution between factors. It is clear that any increase in the supply of highly skilled labor ( $\hat{L}_S > 0$ ), ceteris paribus, implies a reduction in real wages for highly skilled natives ( $\hat{w}_S < 0$ ) and a rise in real wages for low skilled natives ( $\hat{w}_U > 0$ ). Alternatively, inflows of low skilled labor ( $\hat{L}_U > 0$ ), ceteris paribus, will raise

real wages of highly skilled natives ( $\hat{w}_S > 0$ ) and reduce real wages of low skilled natives ( $\hat{w}_U < 0$ ). These are the two scenarios presented in the survey experiment. Of course, if there are inflows of both highly skilled and low skilled immigrants, the wage effects will depend on the impact of the inflows on relative factor supplies ( $\hat{L}_S - \hat{L}_U$ ).

Assume that the government provides public services to all individuals residing in the country and that these services are consumed in equal amounts by all and valued at  $b$  per person (so that they are, in effect, a lump sum transfer of  $b$  to each resident). Government spending is financed by a proportional income tax, set at rate  $\tau$ , so that the government budget constraint is:

$$\tau (w_S L_S + w_U L_U + E) = b (L_S + L_U) \quad (6)$$

where  $E = \sum e^n$ . The after-tax income of the  $n$ -th native is:

$$I_j^n = (1 - \tau) (w_j + e^n) + b \quad (7)$$

Immigration can affect the after-tax income of a native by altering wage rates, but also by affecting the tax rate or the provision of government services (or both).

In line with previous approaches, we assume that the government will adjust to any change in fiscal circumstances by *either* adjusting the tax rate *or* by adjusting spending. In the first case, holding  $b$  constant and totally differentiating equation 6 yields:

$$\hat{\tau} = (\lambda_S - \phi_S) \hat{L}_S + (\lambda_U - \phi_U) \hat{L}_U - \phi_E \hat{E} \quad (8)$$

where  $\lambda_j$  is the share of  $L_j$  in the population and  $\phi_j$  is the distributive share of  $L_j$  in total income ( $Q + E$ ). Assuming  $w_S > w_U$ , then  $\lambda_U - \phi_U > 0$  and it is clear that inflows of low skilled immigrants ( $\hat{L}_U > 0$ ) necessitate raising the tax rate, all else equal, as taxes on their wages (at the current rate) will not cover the additional spending on the government services they consume. It is possible that such immigrants could arrive with endowments ( $\hat{E} > 0$ ) enough to generate an offsetting increase in tax revenues, but the standard assumption is that low skilled immigrants have zero taxable assets. The arrival of highly skilled immigrants ( $\hat{L}_S > 0$ ) will lead to a reduction in the tax rate, all else equal, if  $\lambda_S - \phi_S < 0$ , which is the case when  $E < L_U(w_S - w_U)$ . The intuition here is that highly skilled immigrants will raise per capita before-tax income, which at the fixed levels of per

capita government spending allows a reduction in the tax rate (as long as endowments do not represent a large proportion of national income). This tax relief affect is accentuated to the extent that highly skilled immigrants bring taxable endowments.

After totally differentiating equation 7, we can describe the impact of immigration on native  $n$ 's after-tax income:

$$\hat{I}_j^n = \frac{w_j(1-\tau)\hat{w}_j - \tau G_j^n \hat{\tau}}{(1-\tau)G_j^n + b} \quad (9)$$

where gross (before-tax) income  $G_j^n = (w_j + e^n)$ . What can we now say about the impact of different types of immigration on the net income of natives? Holding aside the wage effect, which we know (from equations 4 and 5 above) will hinge on the skill level of the particular native, it is easy to see that the impact will vary with income. Combining 8 and 9, and assuming for simplicity that  $\hat{E} = 0$ , it is straightforward to show that with inflows of low skilled immigrants ( $\hat{L}_U > 0$ ), the tax rate must rise ( $\hat{\tau} > 0$ ), net incomes fall ( $\hat{I}_j^n < 0$ ), and the losses are magnified for natives with higher gross incomes ( $\partial \hat{I}_j^n / \partial G_j^n < 0$ ). Conversely, with inflows of highly skilled immigrants ( $\hat{L}_S > 0$ ), the tax rate falls ( $\hat{\tau} < 0$ ) as long as  $E < L_U(w_S - w_U)$ , net incomes rise ( $\hat{I}_j^n > 0$ ), and the gains are greater for those with higher before-tax incomes ( $\partial \hat{I}_j^n / \partial G_j^n > 0$ ). In sum, richer natives lose more than poorer counterparts from the entry of low skilled immigrants, and they gain more with the arrival of highly skilled immigrants.

The overall effect of immigration on the net income of native  $n$ , with skill level  $j$ , will depend on the combination of wage and tax effects. For low skilled natives, these effects are always in the same direction: inflows of low skilled immigrants will reduce wages ( $\hat{w}_U < 0$ ) and raises taxes, while inflows of highly skilled workers raises wages ( $\hat{w}_U > 0$ ) and reduces taxes. Highly skilled natives have a more complicated calculation: low skilled immigrants raise their wages ( $\hat{w}_S > 0$ ) but also increase the tax burden; highly skilled immigrants push down wages ( $\hat{w}_S < 0$ ) but also decrease taxes.

What if the government adjusts to the change in fiscal circumstances by adjusting spending while keeping the tax rate fixed? In this second case, holding  $\tau$  constant and totally differentiating equation 6 yields:

$$\hat{b} = -(\lambda_S - \phi_S) \hat{L}_S - (\lambda_U - \phi_U) \hat{L}_U + \phi_E \hat{E} \quad (10)$$

The impact of immigration on the per-capita provision of government services when taxes are fixed is just the exact reverse of the effect on the tax rate when spending is fixed. Inflows of low skilled immigrants ( $\hat{L}_U > 0$ ) necessitate a reduction in per-person services ( $\hat{b} < 0$ ), assuming such immigrants bring no taxable endowments. Highly skilled immigrants ( $\hat{L}_S > 0$ ) generate an expansion in services ( $\hat{b} > 0$ ).

Totally differentiating equation 7, this time assuming no change in the tax rate but an adjustment in spending, we get:

$$\hat{I}_j^n = \frac{w_j(1-\tau)\hat{w}_j + b\hat{b}}{(1-\tau)G_j^n + b} \quad (11)$$

Controlling for the wage effect, and assuming  $\hat{E} = 0$ , it is easy to show that with inflows of low skilled immigrants ( $\hat{L}_U > 0$ ) per-capita services must be cut ( $\hat{b} < 0$ ) and net incomes fall ( $\hat{I}_j^n < 0$ ); these losses are smaller for natives with higher gross incomes ( $\partial\hat{I}_j^n/\partial G_j^n > 0$ ). Inflows of highly skilled immigrants ( $\hat{L}_S > 0$ ) result in an expansion of services ( $\hat{b} > 0$ ) and an increase in net incomes ( $\hat{I}_j^n > 0$ ), but these gains are smaller for those with higher incomes ( $\partial\hat{I}_j^n/\partial G_j^n < 0$ ). In this case, the stakes are largest for the poorest natives: poor natives are hurt more than richer natives by low skilled immigration, and they benefit more than richer counterparts from highly skilled immigration.