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Can a deportation policy backfire?

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Abstract

Drawing on a model in which utility is derived from consumption and effort (labor supply), we ask how the deportation of a number of undocumented migrants influences the decisions regarding labor supply, consumption, and savings of the remaining undocumented migrants. We assume that the intensity of deportation serves as an indicator to the remaining undocumented migrants when they assess the probability of being deported. We find that a higher rate of deportation induces undocumented migrants to work harder, consume less and, as a result of those responses, to save more. Assuming that the purpose of deportation policy is to reduce the aggregate labor supply of undocumented migrants in order to raise the wages of low-skilled native workers, we conclude that the policy can backfire: an increase in the labor supply of the remaining undocumented migrants can more than offset the reduction in the labor supply arising from the deportation of some undocumented migrants. Simulation shows that if the number of deportations in relation to the size of the undocumented migrant workforce is small, then the combined effect of the reduction in the labor supply of the deportees and the increase in the labor supply of the remaining undocumented migrants can be that the aggregate labor supply of undocumented migrants will increase. It follows that an effective deportation policy has to involve the expulsion of a substantial proportion of the total number of undocumented migrants in the workforce.

Keywords: Consumption of undocumented migrants; Labor supply of undocumented migrants; Savings of undocumented migrants; Aggregate labor supply of undocumented migrants; Efficacy of a deportation policy of a number of undocumented migrants

JEL classification: D81; E21; F22; J61; J78

1 Introduction

In a speech on October 5, 2016, UK Prime Minister Theresa May said that "[for] someone who finds themselves out of work or on lower wages because of low-skilled immigration, life simply doesn't seem fair," and announced that her cabinet will "restore fairness."[1] At his first State of the Union address on January 30, 2018, US President Donald Trump said that "[f]or decades, open borders have allowed . . . millions of low-wage workers to compete for jobs and wages against the poorest Americans."[2] In a series of tweets on June 24, 2018, he proposed that undocumented migrants should be deported "with no Judges or Court Cases."[3] In a televised speech on July 4, 2018, the German Interior Minister Horst Seehofer noted that 69 failed asylum seekers were deported on that day, which happened to be the Minister's 69th birthday. The Minister's widely publicized remark served as a stark reminder that the likelihood of deportation from Germany of undocumented migrants is anything but a remote possibility. It also aligned with a vow of the EU "to step up deportations of failed asylum seekers - part of a complex and controversial drive against illegal migration."[4] In September 2018, the UK Government's independent Migration Advisory Committee issued a report noting that migration to the United Kingdom has had some negative impacts on lower-paid or lower-skilled native workers (MAC 2018). On December 16, 2017, *The Economist* reported that in the United States "over the past fiscal year, deportations of [illegal] immigrants have increased by a quarter." The current massive undocumented migration of Venezuelans raises a concern in the neighboring migrant-receiving Latin American countries that "many of the new arrivals will compete for unskilled jobs, perhaps depressing wages" (*The Economist*, October 6, 2018). The foregoing examples of perceptions, concerns, and real-world actions suggest that the topic of deportation of undocumented migrants is anything but negligible.

The perception that deportation is used as a policy tool to relieve "downward pressure" on "domestic wages" is not a new concern in recent announcements, declarations, and events. In an analysis done more than three decades ago aimed at explaining variations in US migration policy enforcement during 1900-1982, Shughart et al. (1986, p. 91) note that "immigration authorities use deportations [of 'illegal aliens']" as a means of "mitigating

[1] https://www.bbc.co.uk/news/uk-politics-37556019.
[2] https://www.theguardian.com/us-news/2018/jan/30/the-full-text-of-trumps-state-of-the-union-address.
[3] https://www.reuters.com/article/us-usa-immigration-trump/trump-says-illegal-immigrants-should-be-deported-with-no-judges-or-court-cases-idUSKBN1JK0OL.
[4] https://www.bbc.com/news/world-europe-44778737.

downward . . . pressure on wages." Although the main thrust of the analysis by Shughart et al. is to demonstrate that variations in migration policy enforcement are attributable to a desire of organized interest groups to influence domestic wages, the analysis suggests that the extent and intensity (numbers) of deportations in a given year are aimed in part at protecting the earnings of native workers.[5]

In this paper we assess the efficacy of a deportation policy against the policy's declared aims. We consider a country that hosts undocumented migrants or asylum seekers whose cases for asylum are tenuous.[6] We refer to such people as "undocumented migrants." We ask what happens to the supply of undocumented migrant labor when the country deports some of them, given that the reason for so doing is concern that undocumented migrants compete with low-skilled native workers, putting downward pressure on the wages of those workers. The expectation underlying the policy is that following the deportations, the aggregate supply of low-skilled labor will be reduced and, consequently, the wage earnings of low-skilled native workers will increase.

We show that the responses of the remaining undocumented migrants to the deportation of fellow undocumented migrants can weaken, or even neutralize, a deportation policy aimed at raising native-born workers' wages. Our reasoning is as follows. The deportation of a certain number of undocumented migrants is an indicator or an input for the remaining undocumented migrants in calculating the probability of their own deportation. Deportation is tantamount to a wage cut, given that wages in the home country are lower than

[5] Writings in political economy and public choice view deportations as the outcome of competition in policy formation between low-skilled workers, high-skilled workers, and owners of capital. In addition to the study by Shughart et al. (1986), we can cite here as examples of (analytical and empirical) studies noting that native low-skilled workers favor a restrictive migration policy, Benhabib (1996), who shows that restrictive migration policies will be supported by individuals owning little capital, presumably low-skilled workers; Söllner (1999), who develops a model showing that unlike high-skilled workers and capital owners, low-skilled workers are harmed by the arrival of (low-skilled) migrants; Razin and Wahba (2015), who maintain that low-skilled native workers will vote against admitting low-skilled migrants; Scheve and Slaughter (2001), who find that in the United States low-skilled workers favor limiting the inflow of migrants; and Stichnoth (2012), who finds that in regions in Germany in which the proportion of unemployed foreign workers among the unemployed labor force is large, native workers are less supportive of state unemployment programs (an attitude that can be interpreted as indirect evidence of hostility towards migrants). While those studies have addressed to different extents issues related to public policy responses to migration, none have explored the effects on the aggregate supply of illegal migrant labor associated with the deportation of illegal migrants. Seen in this way, our analysis complements the existing literature.

[6] "[On June 27, 2018,] Ireland became one of the last countries in the European Union to grant employment rights to asylum seekers . . . leaving Lithuania as the only EU country to prevent asylum seekers from working." Reuters, June 27, 2018 (https://www.reuters.com/article/us-ireland-asylum/ireland-to-allow-asylum-seekers-to-work-for-first-time-idUSKBN1JN2AX).

wages in the host country. A higher perceived probability of expulsion induces an undocumented migrant to increase his labor supply and to use additions to his earnings to beef up his savings, as a reservoir to tap into in the event of being deported. When a reduction in the labor supplied by the departing undocumented migrants is accompanied by an increase in the labor supplied by the remaining undocumented migrants, the deportation policy does not succeed in achieving its intended purpose.

In order to study the reaction of undocumented migrants to the deportation of fellow undocumented migrants, we assume that the undocumented migrants, who live for two periods, choose the amount of labor they supply and their level of consumption so as to maximize their intertemporal utilities. In the beginning of the first period, some undocumented migrants are deported from the host country. Based on the intensity of the deportations, the remaining undocumented migrants make assumptions regarding the likelihood that they will be deported at the beginning of the second period. The perceived probability of being deported enters the undocumented migrants' utility negatively and appears as a term in their chosen *first-period* labor supply, consumption, and savings. We find that a policy shift that leads to an increase in that probability prompts undocumented migrants to work harder, consume less and, as a consequence of both responses, to save more in the first period of their lives. A simulation exercise helps illustrate such responses and their magnitudes.

Whereas the effects of the deportation of undocumented migrants on native workers have been studied (Chassamboulli and Peri 2015; Machado 2017), very little research has been conducted on the impact of deportations of some undocumented migrants on the behavior of the remaining undocumented migrants. Vinogradova (2016) develops a stochastic life-cycle model aimed at showing that a strict deportation policy leads to increased voluntary returns of undocumented migrants to their home countries. That response leads to a reduction, rather than to an increase, in the aggregate labor supplied by undocumented migrants. However, in her model, Vinogradova abstracts from *individual* labor supply considerations, assuming that migrants supply their labor inelastically. In contrast, by allowing for endogenous determination of individual labor supply, we obtain the result that a tougher deportation policy induces undocumented migrants to work harder. Such a reaction can lead to an increase in the aggregate labor supply of undocumented migrants, even though following deportations, the number of undocumented migrants in the host country declines.

Moreover, even if, as reasoned by Vinogradova, a severe threat of deportation were to trigger voluntary returns, our result will be strengthened because prior to the rise in voluntary returns, undocumented migrants presumably will double their work effort.

It might be argued that our analysis is wanting because we do not address the possibility that undocumented migrants might plan to stay in the host country for just a single period, in which case they will be oblivious to changes in the probability of deportation in a subsequent period. But that neglect is only apparent: we can always think of an increase in the intensity of deportations as being interpreted by an undocumented migrant as a shortening of his stay in the host country, such that the timing of his forced return will precede that of his planned return.

In addition to contributing to a better understanding of the reactions of undocumented migrants to the deportation of fellow undocumented migrants, our study of the consequences of changing the probability of deportation sheds light on the more general subject of the responses of individuals to a change in the probability of a lower future income. From what we know, no paper to date has presented a unified model of labor supply and consumption decisions, showing that savings set aside to cover the possibility that tomorrow's earnings will be lower than today's earnings result *both* from reduced consumption today out of current earnings, and from higher earnings today yielded by increased labor supply. Flodén (2006) shows that a larger variance in tomorrow's income, holding constant tomorrow's expected income, induces an individual to save more today by reducing his current consumption and by increasing his current labor supply. However, Flodén's result does not carry through to a setting in which the driver of increased savings is a decline in expected future income rather than an increase in the variance of that income. After all, income variance depends on expected income, and a reduction in expected income can well *reduce* income variance, in which case changes in the expected value of income and its variance may have opposing effects on the individual's saving behavior. Our analysis reveals that Flodén's result is robust to a reformulation of the nature of uncertainty regarding future earnings.

2 A unified model of intertemporal utility from consumption and labor supply: The case of undocumented migration

2.1 Modeling the labor supply of an individual undocumented migrant

In country *d* (we use *d* for "destination"), undocumented migrants arrive motivated by an international wage differential. The wage per unit of labor in country *d* is w^d. The wage per unit of labor in the home country *h* (we use *h* for "home") is w^h. Naturally, we assume that $0 < w^h < w^d$. We introduce the following characterizations.

The undocumented migrants live for two periods. Denoting consumption by *c* and effort (labor supply) by *l*, intertemporal utility, $U(c_1, c_2, l_1, l_2)$, derived from first-period utility, $u(c_1, l_1)$, and from second-period utility, $u(c_2, l_2)$, is

$$U(c_1, c_2, l_1, l_2) = u(c_1, l_1) + \delta u(c_2, l_2),$$

where $\delta \in (0,1)$ denotes the discount factor. Standard non-negativity constraints apply to c_t and to l_t, $t = 1, 2$. The per period utility function $u(c,l)$ is strictly increasing in *c*, strictly decreasing in *l*, and is strictly concave such that $\frac{\partial u(c,l)}{\partial c} \equiv u_c(c,l)$, $\frac{\partial u(c,l)}{\partial l} \equiv u_l(c,l)$, $\frac{\partial u^2(c,l)}{\partial c^2} \equiv u_{cc}(c,l)$, $\frac{\partial u^2(c,l)}{\partial l^2} \equiv u_{ll}(c,l)$, and $\frac{\partial u^2(c,l)}{\partial c \partial l} \equiv u_{cl}(c,l)$, which implies that $u_c(c,l) > 0$, $u_l(c,l) < 0$, $u_{cc}(c,l) < 0$, $u_{ll}(c,l) < 0$, and $u_{cc}(c,l)u_{ll}(c,l) - u_{cl}(c,l)^2 > 0$. We assume that $\lim_{c \to 0} u_c(c,l) = +\infty$, and that $\lim_{l \to +\infty} u_l(c,l) = -\infty$. Those limit assumptions rule out, respectively, zero consumption and work to exhaustion.

In the beginning of the first period, country *d* deports some of the undocumented migrants. In the wake of that deportation, the remaining undocumented migrants make assumptions regarding the likelihood of their own deportation at the (beginning of the) subsequent period. Those expectations yield probability $p \in (0,1)$: the remaining undocumented migrants believe that in the second period of their lives they will stay in country *d* with probability $1 - p$, in which the prevailing wage will be w^d per unit of labor; and that they will be deported to their home country with probability *p*, in which case the prevailing wage will be w^h per unit of labor. Faced with this uncertainty regarding the country in which they will be able to work in the second period of their lives, the

undocumented migrants choose how much labor to supply in the first period and how to allocate their consumption between the two periods, which is tantamount to choosing how much to save, *s*, in the first period. (Assuming that the purpose of saving is to support future consumption, savings play no role in the second and last period of life.) The migrants' choices are governed by a desire to maximize their intertemporal utility function.

The first-period consumption of a migrant is

$$c_1 = w^d l_1 - s. \tag{1}$$

Given the exogenous probability *p* of ending up working in the home country in the second period of life, then with probability $1-p$ an undocumented migrant remains in the destination country, and his second-period consumption is

$$c_2^d = w^d l_2^d + (1+\bar{r})s, \tag{2}$$

and with probability *p* the second-period consumption of an undocumented migrant is

$$c_2^h = w^h l_2^h + (1+\bar{r})s, \tag{3}$$

where $\bar{r}$ denotes the rate of return on savings, assumed to be set at the world level. The lifetime income constraint of an undocumented migrant if he will not be subject to deportation is

$$c_1 + \frac{1}{1+\bar{r}} c_2^d = w^d l_1 + \frac{w^d}{1+\bar{r}} l_2^d. \tag{4}$$

The lifetime income constraint of an undocumented migrant if he will be deported is

$$c_1 + \frac{1}{1+\bar{r}} c_2^h = w^d l_1 + \frac{w^h}{1+\bar{r}} l_2^h. \tag{5}$$

The migrant chooses c_1, c_2^d, c_2^h, l_1, l_2^d, and l_2^h so as to maximize the following Lagrangian:

$$\begin{aligned} H = (1-p)\left[u(c_1, l_1) + \delta u(c_2^d, l_2^d) + \lambda\left(w^d l_1 + \frac{w^d}{1+\bar{r}} l_2^d - c_1 - \frac{1}{1+\bar{r}} c_2^d \right) \right] \\ + p\left[u(c_1, l_1) + \delta u(c_2^h, l_2^h) + \mu\left(w^d l_1 + \frac{w^h}{1+\bar{r}} l_2^h - c_1 - \frac{1}{1+\bar{r}} c_2^h \right) \right] \end{aligned} \tag{6}$$

where λ is a Lagrange multiplier that measures the marginal utility of earnings when they are derived in their entirety from work in country *d*, and μ is a Lagrange multiplier that measures the marginal utility of earnings when they are derived partly from work in country *d*, and partly from work in the home country. Taking several algebraic steps aimed at substituting for λ and μ, the first-order conditions obtained from (6) yield intertemporal relationships for consumption

$$u_c(c_1, l_1) = \delta(1+\overline{r})\left[(1-p)u_c(c_2^d, l_2^d) + pu_c(c_2^h, l_2^h)\right], \tag{7}$$

and for labor supply

$$u_l(c_1, l_1) = \delta(1+\overline{r})\left[(1-p)u_l(c_2^d, l_2^d) + p\frac{w^d}{w^h}u_l(c_2^h, l_2^h)\right]. \tag{8}$$

Also, the first-order conditions bind the consumption and labor supply per period

$$\frac{u_l(c_1, l_1)}{u_c(c_1, l_1)} = \frac{u_l(c_2^d, l_2^d)}{u_c(c_2^d, l_2^d)} = -w^d, \tag{9}$$

and

$$\frac{u_l(c_2^h, l_2^h)}{u_c(c_2^h, l_2^h)} = -w^h, \tag{10}$$

respectively. Given the properties of the per period utility function ensuring that the second-order condition for a maximum is satisfied, equations (7) through (10) together with constraints (4) and (5) uniquely determine the levels of consumption and labor supply that maximize (6). We denote those optimal levels by c_1^*, c_2^{d*}, c_2^{h*}, l_1^*, l_2^{d*}, and l_2^{h*}.

Suppose now that country *d* intensifies its deportation policy, expelling a relatively large proportion of its undocumented migrant workforce at the beginning of the first period (larger than that which led to the probability of deportation estimated at the level *p*). That policy action is interpreted by the remaining undocumented migrants as a prospective increase in the likelihood of their own deportation at the beginning of the second period. Taking the first-period optimal values of the variables as functions of the probability of deportation, we ask what would happen to those values if the probability increased. To that end, we formulate and sign the relationships between the probability of deportation and labor supply, and between the probability of deportation and consumption.

Claim 1. The higher the probability of deportation, the larger the labor supply of an undocumented migrant in the first period.

Proof. The proof is in the Appendix.

Claim 2. The higher the probability of deportation, the lower the consumption of an undocumented migrant in the first period.

Proof. The proof is in the Appendix.

Interestingly, an undocumented migrant responds to a higher probability of deportation by consuming less in the first period, in spite of him supplying more labor in that period.

Claims 1 and 2 together with constraint (1) on a migrant's first-period consumption yield the following result.

Corollary. The higher the probability of deportation, the larger the savings of an undocumented migrant.

In sum, at the optimum, the response of an undocumented migrant to a higher probability of deportation is to work harder, to consume less, and to save more.

2.2 The effect of deportations on the aggregate labor supply of undocumented migrants

In Subsection 2.1, we have shown that a deportation policy that reduces the number of undocumented migrants in country *d*, induces the remaining undocumented migrants to work harder. We now ask whether the combined effect of the reduction in the labor supply of the undocumented migrants because of deportations and the increase in the labor supply of the remaining undocumented migrants can be such that the *aggregate* labor supply of the undocumented migrant workforce in country *d* increases. When the proportion of deported undocumented migrants in the undocumented migrant workforce is substantial, the aggregate labor supply of the undocumented migrants is bound to fall. This is so because the labor supplied by an undocumented migrant cannot be arbitrarily large, which follows from the assumption that in the limit the marginal disutility of labor supply is infinitely high. Thus, when the proportion of the remaining undocumented migrants in the total workforce of undocumented migrants becomes small, the aggregate labor supply of the undocumented migrants also will be small, in spite of each of the remaining undocumented migrants increasing his supply of labor. However, when the number of deportees relative to the size of

the undocumented migrant workforce is small, then the sum of the increases in the labor supply of each of the remaining undocumented migrants can be such as to offset the reduction in the aggregate labor supply of the undocumented migrants; the relationship between deportations and the aggregate labor supply of undocumented migrants can thus be inverse U-shaped.

In Table 1, we present a simulation exercise based on our model. The results displayed are for a constant elasticity of substitution per period utility function $u(c,l)=\frac{c^{1-\sigma}}{1-\sigma}-\alpha\frac{l^{1+\gamma}}{1+\gamma}$, where *c* and *l* are as defined in Subsection 2.1; α represents the intensity of the disutility of labor (toil); and σ and γ are the inverses of the elasticities of intertemporal substitution (EIS) in consumption and in labor supply, respectively. We perform simulation for parameter values $\sigma=2$ and $\alpha=1$ in the constant elasticity of substitution per period utility function, and for parameter values $\delta=0.8$, $\bar{r}=0.1$, $w^d=4$, and $w^h=1$, where δ, $\bar{r}$, w^d, and w^h were defined in Subsection 2.1. Those choices of values are premised on the following considerations. Setting $\sigma=2$ tracks estimates of the EIS in consumption reported in the received literature.[7] Assuming that the duration of the first period of (working) life is about five years, then a five-year discount rate of $\delta=0.8$ and an interest rate of $\bar{r}=0.1$ correspond to annual rates of about $\delta=0.96$ and $\bar{r}=0.02$, respectively. For example, the annual interest rate of $\bar{r}=0.02$ is the average rate for US federal funds in 2018.[8] We assume that the wage in the destination country *d* is four times higher than the wage in the home country *h* which, again as an example, corresponds to the 2017 wage difference between the United States and Mexico.[9] We conduct a simulation for three values of γ: $\gamma=1.75$, $\gamma=2$, and $\gamma=2.25$.[10] For ease of reference, the simulation is performed for a population of 100 undocumented migrants.

[7] Havranek et al. (2015) report that in empirical studies, the mean estimate of the EIS in consumption is 0.5, which corresponds to $\sigma=2$.

[8] https://www.federalreserve.gov/monetarypolicy/openmarket.htm

[9] https://stats.oecd.org/Index.aspx?DataSetCode=AV_AN_WAGE

[10] In the existing empirical literature dating from the 1980s, estimates of the EIS in labor supply usually are small - between 0.15 and 0.31 - possibly constituting underestimates (Keane and Rogerson 2012). Imai and Keane (2004) find that when the impact of learning-by-doing on workers' lifecycle wage paths is taken into account, then the EIS in labor supply can be as high as 3.8. Noting that in terms of labor supply, undocumented migrants are characterized by a lower EIS than non-migrants (Borjas 2017), we chose to utilize for the EIS in labor supply a range of values that is closer to the estimates in the studies dating from the 1980s.

Column 1 presents four alternative probabilities of deportation, *p*. Obviously, the probability of deportation is determined by the number of undocumented migrants deported, *n*, according to the formula $p = n/100$. Different probabilities thus reflect different levels of intensity of the deportation policy. Columns 2, 4, and 6 list optimal first-period labor supply, l_1^*, for $\gamma = 1.75$, $\gamma = 2$, and $\gamma = 2.25$, respectively. Columns 3, 5, and 7 list the aggregate first-period labor supply of the remaining undocumented migrants, L_1, calculated according to the formula $L_1 = (100 - n)l_1^*$, for $\gamma = 1.75$, $\gamma = 2$, and $\gamma = 2.25$, respectively.

Table 1 Simulation of the optimal first-period labor supply and aggregate labor supply of undocumented migrants

1	2	3	4	5	6	7
p	$\gamma = 1.75$		$\gamma = 2$		$\gamma = 2.25$	
	l_1^*	L_1	l_1^*	L_1	l_1^*	L_1
0.00	0.667	66.70	0.686	68.60	0.702	70.20
0.05	0.715	67.93	0.730	69.35	0.744	70.68
0.10	0.744	66.96	0.757	68.13	0.768	69.12
0.20	0.782	62.56	0.792	63.36	0.801	64.08

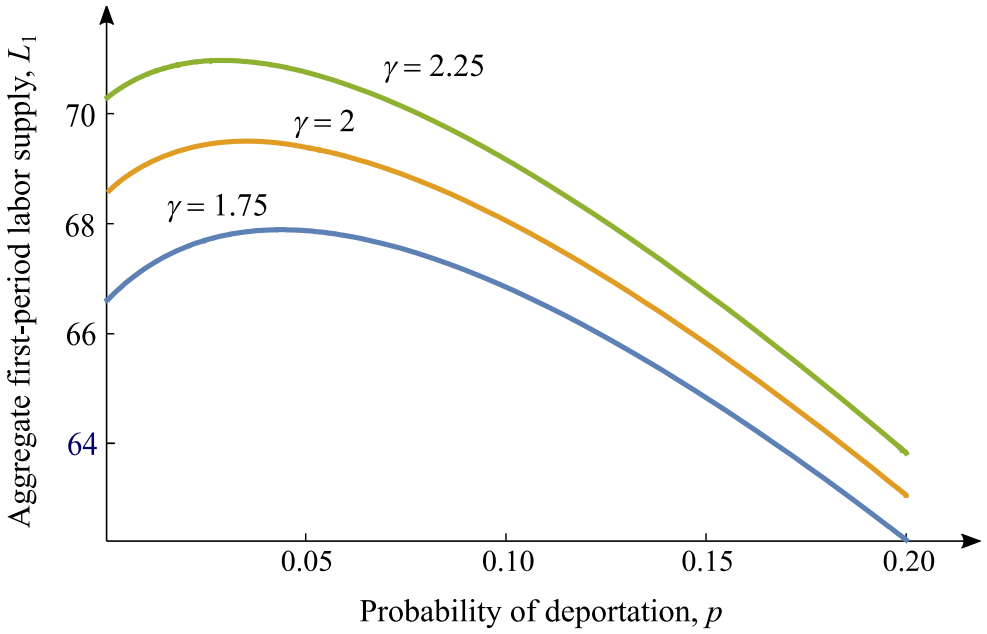
Note: The calculations are for per period utility function $u(c,l) = \frac{c^{1-\sigma}}{1-\sigma} - \alpha \frac{l^{1+\gamma}}{1+\gamma}$, where *c* is consumption, and *l* is labor supply. We assume that the inverse of the elasticity of intertemporal substitution in consumption is $\sigma = 2$; the intensity of the disutility of labor is $\alpha = 1$; the discount rate is $\delta = 0.8$; the interest rate is $\bar{r} = 0.1$; the wage per unit of labor in country *d* is $w^d = 4$; and the wage per unit of labor in country *h* is $w^h = 1$.

As predicted by our model, the calculations in Table 1 reveal that the higher is the probability of deportation, the harder the undocumented migrants will work; the higher is *p*, the higher is l_1^*. If the purpose of the deportation policy is to reduce the supply of undocumented migrant

labor so as to raise the wages of low-skilled native workers, then the policy can backfire.[11] That consequence can arise when the number of deportees is small relative to the total number of undocumented migrants. For example, for $\gamma = 2$, deportation of 5% of the undocumented migrant workforce will lead to an increase in the labor supplied by each remaining undocumented migrant by 6.41% (from 0.686 units of time to 0.730 units of time), as well as to an *increase* of the aggregate labor supply of undocumented migrants by 1.01% (from 68.60 units of time to 69.35 units of time). On the other hand, when the number of deportees is relatively large, as when, for example, 20% of the undocumented migrant workforce is deported, then the deportation policy will achieve its intended goal. The relationship between the probability of deportation and the aggregate first-period labor supply of the remaining undocumented migrants for the per period utility function and for the parameter values used to construct Table 1 is depicted in Figure 1.

[11] We implicitly assume that the size of the undocumented migrant workforce relative to the size of the low-skilled native workforce is significant, or else deportations will not be an effective tool for raising the wages of low-skilled native workers.

Fig. 1 Simulating the aggregate first-period labor supply of the remaining undocumented migrants, as a function of the probability of deportation.



The results of the simulation align with the perception that if a deportation policy is to be an effective tool for raising the wages of low-skilled native workers, the number of undocumented migrants deported in relation to the total number of undocumented migrants has to be substantial.

3 Discussion and conclusions

A unified two-period model of intertemporal preferences for consumption and labor supply enables us to trace the choices of undocumented migrants who face the possibility that their future earnings will be lower than their current earnings. Second-period earnings will fall upon deportation to the home country. The probability of deportation enters the undocumented migrants' utility negatively, and it affects their chosen first-period labor supply, consumption, and savings. We show that a higher probability of deportation results in unambiguous changes in those decisions.

Assessing the consequences of a change in the likelihood of deportation is of relevance to a host country when it considers expelling undocumented migrants: if the host country seeks to reduce the supply of undocumented migrants because they compete with native workers of comparable skill levels, then expelling some undocumented migrants may not be as effective as contemplated; the deportation policy could work against its intended goal.

The inverse of a higher probability of deportation is a higher probability of remaining in the destination country. Our results align with the existing, if sparse, empirical literature on the economic consequences of legalizing undocumented migrants (in our setting, that is tantamount to lowering the "threat" of deportation). Evidence has been reported that legalization reduces participation in the labor force (Borjas and Tienda 1993; Amuedo-Dorantes et al. 2007; Amuedo-Dorantes and Bansak 2011), yet the underlying reasons are not well understood.[12] Amuedo-Dorantes et al. (2007) and Amuedo-Dorantes and Bansak (2011) attribute the reduction in labor force participation by undocumented migrants when their stays are legalized to increased job mobility in the case of skilled men, and to acquisition of eligibility for social services in the case both of unskilled men and of women. Our model implies that a reduction in the labor supply of undocumented migrants as a result of legalization is an optimal response to a reduced probability of deportation.

An intriguing possibility would be that deportations of some undocumented migrants might be interpreted by the remaining undocumented migrants that the storm has passed for good, rather than that such storms are now part of a "new reality," in which case the reaction of the remaining undocumented migrants could be the inverse of what we have assumed. Our approach is based on the presumption that actual deportation rather than a verbal threat of deportation constitutes a demonstration effect in the sense that an undocumented stay can never be taken to be a secure stay. Deportations signal that the government of the destination country has shown that it "means business," a stance to which undocumented migrants better take notice.[13] An interesting topic for follow-up research would nevertheless be, after a

[12] Other empirically observed consequences of legalizing undocumented migrants include an increase in earnings (Borjas and Tienda 1993; Kossoudji and Cobb-Clark 2002; Amuedo-Dorantes et al. 2007; Amuedo-Dorantes and Bansak 2011), a reduction in remittances sent home (Amuedo-Dorantes and Mazzolari 2010), and a decline in crime rates (Pinotti 2017).

[13] Consulting Table 6 in https://www.dhs.gov/sites/default/files/publications/Enforcement_Actions_2016.pdf reveals that in the United States during the 2010-2016 period, on average the country deported annually 384,130

deportation drive, to sample undocumented migrants who were not deported in order to determine directly whether their response is as has been assumed by us. A similar comment applies to research on the consequences of legislation: rather than study, as existing research has done, the labor force participation decisions of undocumented migrants who were legalized, to study the labor force responses of comparable undocumented migrants who were not legalized.

We are aware that our analysis is not of a general equilibrium type, and that considerations of dynamic repercussions could contribute further to an informed assessment of deportation policies. For example, suppose that as a consequence of deportations, firms in the host country find it necessary to increase the wages paid for low-skilled work so as to attract native workers to fill positions vacated by the deported migrants. Although that change could appear to serve the intention of the policy in that it confers benefits on the native workers who now face reduced competition for jobs, it actually can undermine the policy if the higher wages trigger additional undocumented migration. As yet another example, suppose that when more undocumented migrants are deported, the remaining undocumented migrants expect higher wages because of lesser labor market competition. Our results presumably will still hold, although the effect of an increased effort in the first period will be weaker. And as a third example, a reduction in the attractiveness of undocumented migration could render legal migration relatively more attractive.[14] If legal migrants substitute for deported undocumented migrants, the effect identified by us on the wages of low-skilled native workers will be stronger. However, because by definition legal migration is manageable, it will not lead to unchecked competition with low-skilled native workers and unwarranted downward pressure on the wages of these native workers.

We also are well aware that our findings do not account for all of the consequences of an increase in the probability of deportation of undocumented migrants. Other effects could be envisaged, such as lesser tendency to acquire host-country specific human capital, reduced inclination to acquire housing, and so on. Nonetheless, it is informative as well as policy-

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aliens. The largest deportation effort was in 2013 (433,034), the smallest in 2015 (326,962). Those data indicate that deportations from the United States are recurrent, rather than rare.

[14] In the same context, it is of interest to note that being deported could make it harder for an undocumented migrant to obtain legal entry in the future. Seen in that way, by chipping away at the relative attractiveness of undocumented migration, deportations can lower the incidence of such migration.

relevant to form a first-brush assessment of the effects of various levels of the intensity of deportation on labor supply and on saving behavior, holding other things equal.

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Appendix: Proofs of Claims 1 and 2

Proof of Claim 1. We seek to show that $\frac{dl_1^*}{dp} > 0$. Using (8), we denote $-u_l(c_1^*, l_1^*) + \delta(1+\bar{r})\left[(1-p)u_l(c_2^{d*}, l_2^{d*}) + p\frac{w^d}{w^h}u_l(c_2^{h*}, l_2^{h*})\right] \equiv F$. Because at the optimal solution we have that $F = 0$, we can apply the implicit function theorem to F, which yields

$$\frac{dl_1^*}{dp} = -\frac{\partial F / \partial p}{\partial F / \partial l_1^*} = \frac{\delta(1+\bar{r})\left(\frac{w^d}{w^h}u_l(c_2^{h*}, l_2^{h*}) - u_l(c_2^{d*}, l_2^{d*})\right)}{u_{ll}(c_1^*, l_1^*) - \delta(1+\bar{r})\left[(1-p)\frac{\partial l_2^{d*}}{\partial l_1^*}u_{ll}(c_2^{d*}, l_2^{d*}) + p\frac{w^d}{w^h}\frac{\partial l_2^*}{\partial l_1^*}u_{ll}(c_2^{h*}, l_2^{h*})\right]}. \quad \text{(A1)}$$

To determine the sign of the term on the most right-hand side of (A1), we look first at the denominator. Total differentiation of the budget constraints yields $w^d dl_1^* + \frac{w^d}{1+\bar{r}}dl_2^{d*} = dc_1^* + \frac{1}{1+\bar{r}}dc_2^{d*}$ and $w^d dl_1^* + \frac{w^h}{1+\bar{r}}dl_2^{h*} = dc_1^* + \frac{1}{1+\bar{r}}dc_2^{h*}$. On dividing the two sides in each of those two equations by dl_1^* and on rearrangement, we get that $\frac{dc_1^*}{dl_1^*} + \frac{1}{1+\bar{r}}\frac{dc_2^{d*}}{dl_1^*} - \frac{w^d}{1+\bar{r}}\frac{dl_2^{d*}}{dl_1^*} = w^d$, and that $\frac{dc_1^*}{dl_1^*} + \frac{1}{1+\bar{r}}\frac{dc_2^{h*}}{dl_1^*} - \frac{w^h}{1+\bar{r}}\frac{dl_2^{h*}}{dl_1^*} = w^d$, meaning that a marginal increase in first-period labor supply, which increases lifetime earnings by $w^d dl_1$, requires adjustments in c_1^*, c_2^{d*}, c_2^{h*}, l_2^{d*}, and l_2^{h*} in response. From the assumption that the per period utility function is concave, it follows that an increase in lifetime earnings brought about by a marginal increase in l_1^* entails an increase in c_1^*, in c_2^{d*}, and in c_2^{h*}. And it also entails reductions in l_2^{d*} and in l_2^{h*}, namely $\frac{\partial l_2^{d*}}{\partial l_1^*} < 0$ and $\frac{\partial l_2^{h*}}{\partial l_1^*} < 0$. Next, and again from the assumption that the per period utility function is concave, we have that $u_{ll}(c_1^*, l_1^*) < 0$, $u_{ll}(c_2^{d*}, l_2^{d*}) < 0$, and $u_{ll}(c_2^{h*}, l_2^{h*}) < 0$ which, together with $\frac{\partial l_2^{d*}}{\partial l_1^*} < 0$ and $\frac{\partial l_2^{h*}}{\partial l_1^*} < 0$, imply that the denominator of the term on the farthest right-hand side of (A1) is strictly negative.

Therefore, in order for $\frac{dl_1^*}{dp}$ in (A1) to be positive, we need to verify that the numerator of the term on the farthest right-hand side of (A1) is also negative, which it is if

$\frac{w^d}{w^h}u_l(c_2^{h*},l_2^{h*})-u_l(c_2^{d*},l_2^{d*})$ is negative. Drawing on (9) and (10), the requirement that $\frac{w^d}{w^h}u_l(c_2^{h*},l_2^{h*})-u_l(c_2^{d*},l_2^{d*})<0$ is equivalent to the requirement that $u_c(c_2^{h*},l_2^{h*})>u_c(c_2^{d*},l_2^{d*})$ or, because the per period utility is strictly concave, to the requirement that $u(c_2^{h*},l_2^{h*})<u(c_2^{d*},l_2^{d*})$. Because $w^h<w^d$, the consumption bundle (c_2^{d*},l_2^{d*}) delivers higher utility than the consumption bundle (c_2^{h*},l_2^{h*}) and, therefore, the inequality $u(c_2^{h*},l_2^{h*})<u(c_2^{d*},l_2^{d*})$ holds. Thus, we conclude that $\frac{dl_1^*}{dp}>0$. Q.E.D.

Proof of Claim 2. We seek to show that $\frac{dc_1^*}{dp}<0$. Recalling (7), we write $-u_c(c_1^*,l_1^*)+\delta(1+\bar{r})\left[(1-p)u_c(c_2^{d*},l_2^{d*})+pu_c(c_2^{h*},l_2^{h*})\right]\equiv G$. Because at the optimal solution we have that $G=0$, we can apply the implicit function theorem to *G*, which yields

$$\frac{dc_1^*}{dp}=-\frac{\partial G/p}{\partial G/c_1^*}=\frac{\delta(1+\bar{r})\left(u_c(c_2^{h*},l_2^{h*})-u_c(c_2^{d*},l_2^{d*})\right)}{u_{cc}(c_1^*,l_1^*)-\delta(1+\bar{r})\left[(1-p)\frac{\partial c_2^{d*}}{\partial c_1^*}u_{cc}(c_2^{d*},l_2^{d*})+p\frac{\partial c_2^{h*}}{\partial c_1^*}u_{cc}(c_2^{h*},l_2^{h*})\right]}. \quad \text{(A2)}$$

To determine the sign of the term on the farthest right-hand side of (A2), we look first at the denominator. Total differentiation of the budget constraints yields $w^d dl_1^*+\frac{w^d}{1+\bar{r}}dl_2^{d*}=dc_1^*+\frac{1}{1+\bar{r}}dc_2^{d*}$ and $w^d dl_1^*+\frac{w^h}{1+\bar{r}}dl_2^{h*}=dc_1^*+\frac{1}{1+\bar{r}}dc_2^{h*}$. On dividing the two sides of each of those two equations by dc_1^*, and on rearrangement, we get that $w^d\frac{dl_1^*}{dc_1^*}+\frac{w^d}{1+\bar{r}}\frac{dl_2^{d*}}{dc_1^*}-\frac{1}{1+\bar{r}}\frac{dc_2^{d*}}{dc_1^*}=1$ and that $w^d\frac{dl_1^*}{dc_1^*}+\frac{w^h}{1+\bar{r}}\frac{dl_2^{h*}}{dc_1^*}-\frac{1}{1+\bar{r}}\frac{dc_2^{h*}}{dc_1^*}=1$, meaning that a marginal increase in first-period consumption, which increases lifetime expenditures by dc_1^*, mandates adjustments in c_2^{d*}, c_2^{h*}, l_1^*, l_2^{d*}, and l_2^{h*} to offset that increase. From the assumption that the per period utility function is concave, it follows that an increase in lifetime expenditures brought about by a marginal increase in c_1^* entails an increase in l_1^*, in l_2^{d*}, and in l_2^{h*}. And it also entails reductions in c_2^{d*} and in c_2^{h*}, namely $\frac{\partial c_2^{d*}}{\partial c_1^*}<0$ and $\frac{\partial c_2^{h*}}{\partial c_1^*}<0$. Next, and again from the assumption that the per period utility function is concave, we have that

$u_{cc}(c_1^*, l_1^*) < 0$, $u_{cc}(c_2^{d*}, l_2^{d*}) < 0$ and $u_{cc}(c_2^{h*}, l_2^{h*}) < 0$ which, together with $\frac{\partial c_2^{d*}}{\partial c_1} < 0$ and $\frac{\partial c_2^{h*}}{\partial c_1} < 0$, imply that the denominator of the term on the most right-hand side of (A2) is strictly negative.

Therefore, in order for $\frac{dc_1^*}{dp}$ in (A2) to be negative, we need to check that the numerator of the term on the farthest right-hand side of (A2) is positive, which it is if $u_c(c_2^{h*}, l_2^{h*}) - u_c(c_2^{d*}, l_2^{d*})$ is positive, or, because the per period utility function is strictly concave, if $u(c_2^{h*}, l_2^{h*}) < u(c_2^{d*}, l_2^{d*})$. Because $w^h < w^d$, the consumption bundle (c_2^{d*}, l_2^{d*}) delivers higher utility than the consumption bundle (c_2^{h*}, l_2^{h*}) and, therefore, the inequality $u(c_2^{h*}, l_2^{h*}) < u(c_2^{d*}, l_2^{d*})$ holds. Thus, we conclude that $\frac{dc_1^*}{dp} < 0$. Q.E.D.

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