

The Political Market for Immigration Restrictions: Model and Test*

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Abstract

A two-sector model of the destination economy is developed in order to determine the distributional effects of immigration. In one sector, native and immigrant workers are substitutes in production, while in the other they are complements. The two industries are assumed to draw immigrants from the same pool, whose size is exogenous to employers and set by politicians. A political market for an endogenous immigration quota arises as a consequence of the conflicting interests of the two native worker groups, as well as those of lobbying groups organized along non-labor market lines. A reduced form expression for the equilibrium quota is derived. The size of the quota is determined by the levels of product and labor demand in the two industries, lobbying costs of native workers, the degree of substitutability or complementarity in production between native and immigrant labor, the proportions in which the immigrant workforce is divided between the two industries, the wage elasticities of demand for native and immigrant labor, the influence of groups opposed to immigration on non-economic grounds, and the size of the immigrant population in the destination country. The model is tested using annual data on employment visas issued by U.S. authorities. It is found that political pressure for tighter immigration controls is dominant during periods of economic expansion, while technological progress, a growing immigrant community and a larger share of immigrants from Europe lead to looser immigration restrictions.

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1. Introduction

Much of the literature on the economic effects of immigration reaches a consensus view that, although immigration lowers the wages of native workers who compete with immigrants for jobs, the net welfare effect of immigration in the destination economy is positive.¹ Thus, for example, Borjas (1997) estimates that the annual net gain to the U.S. economy from immigration is about 0.1 percent of GDP,² while Friedberg and Hunt (1995) find that the drop in the wages of even those native workers who are the closest substitutes for immigrants is relatively small,³ as is the reduction in native employment induced by immigration.

It follows that, like any other form of specific protection that hampers the movement of goods or factors between countries, immigration restrictions are wealth reducing in aggregate. The prevalence of such wealth reducing policies has given rise to a political economy literature which attempts to explain the origin of these policies. Immigration regulations are typically characterized as being endogenously produced in a political process. Like trade protection, which benefits import competing industries but hurts consumers, immigration restrictions are generally shown to be redistributive in nature, with certain groups losing and others gaining. For example, Söllner (1999) uses a simple two-sector model to identify the divergent interests of skilled labor, unskilled labor and suppliers of capital. His model confirms earlier findings that immigration of

¹ For a survey see Borjas (1994). See also Friedberg and Hunt (1995).

² A dissenting view, however, is that of Davis and Weinstein (2002), who argue that immigration to the U.S. combined with accompanying capital inflows has produced such a huge increase in domestic output relative to the rest of the world that the U.S.'s terms of trade have deteriorated. They estimate that the total loss of income due to weaker terms of trade amounts to 0.9 percent of U.S. GDP, with an annual burden on native workers of \$72 billion.

³ Using data from the 2000 Census, Card (2005) shows that immigration of unskilled workers has had little effect on the wages of the least-educated native workers. Borjas (2003), however, calculates that a 10 percent increase in immigration lowers the wages of competing native workers by a non-trivial 3 to 4

unskilled labor increases aggregate output but that unskilled wages fall while the returns to capital and skilled labor increase.⁴ Scheve and Slaughter (2001) verify empirically, using individual-level data, that less skilled workers are significantly more likely to prefer limiting immigrant inflows than are other groups of factor owners.⁵ Shughart, Tollison and Kimenyi (1986) implement a model in which immigration policy is determined by a government regulator who weighs the pressures applied by two interest groups, producers and laborers. During recessions the regulator favors labor and during expansions he favors capital and landowners. A similar approach is used by Foreman-Peck (1992) who demonstrates that labor exerts political pressure for tightening immigration restrictions when wages are falling and capital exerts opposing pressure when wages are rising.⁶

Another class of political economy theories is based on the preferences of the median voter. For example, Benhabib (1996) develops a single-sector model with

percent. This same relationship between immigration and wages, and of similar magnitude, is found by Aydemir and Borjas (2006) to apply to other countries apart from the U.S., notably Canada and Mexico.⁴ These results are consistent with Borjas, Freeman and Katz (1996) and with Jaeger (1995) who contend that immigration has contributed to the rising wage gap in the U.S. between workers with and without a high school diploma. Borjas (1997, p. 171) argues that unskilled immigration from Mexico may be responsible for a sizeable redistribution of wealth from less skilled to skilled workers and from labor to capital. However, according to Card (2005), the wage gap between native dropouts and high school graduates has remained relatively unchanged since 1980, despite pressure from low-skilled immigration. Moreover, Card and Lewis's (2005) study of Mexican immigration in the 1990s suggests that Mexican labor inflows had little impact on the relative wage structures of U.S. destination cities, consistent with an earlier finding by Hanson and Slaughter (1999) that local regions are able to absorb inflows of immigrants through output-mix adjustments rather than through changes in relative regional wages. In fact, Ottaviano and Peri (2005) report evidence of a large *positive* effect of overall immigration on average wages of U.S.-born workers.

⁵ Money (1997) finds that public support for tighter immigration controls is especially strong in localities where immigrants concentrate, particularly when those areas experience rapid increases in immigration, rising unemployment and generous immigrant access to social services.

⁶ Haus (1995) suggests that the interest groups shaping immigration policy might also include a transnational element, which creates pressure for more open policies. She argues that such transnational interests explain why we see less restrictive policies today than we did in the 1920s. Chau (2003) uses a political support model to study the differences between border enforcement and employer sanction measures. While the former is essentially an income transfer from employer to native labor interests, the latter generate deadweight welfare losses that are borne entirely by producers. Hanson (2006) notes that U.S. laws regulating cross-border flows of illegal migrants and punishing employers who hire them are

majority voting to investigate the determinants of an immigration policy that specifies minimum or maximum skill or wealth requirements for immigrants. The model demonstrates that, as long as the capital-poor are in the majority in the destination country, restrictive capital or skill requirements are enacted, but that once the capital-rich become the majority, immigration policy becomes less restrictive. Similarly, Flores (1997) uses a single-sector median voter model to show that the destination country's immigration policy is driven primarily by its factor ownership distribution. In his model, an individual's capital-labor ownership determines preferences for immigration restrictions; those owning little capital relative to labor oppose immigration, while those with relatively large endowments of capital favor immigration. Hatton and Williamson (2005) attribute the secular trend toward greater restrictiveness of immigration policy in labor-scarce economies to the declining cost of migration and its impact on immigrant selectivity, together with changes in the identity of the median voter.

In addition to the effects of immigration on factor returns, immigration policy outcomes might also be influenced by such traditionally non-economic causes as security considerations of the nation-state (Rudolph, 2003) or feelings of group-based social identity that induce exclusionary behavior toward immigrants (Sniderman, Hagendoorn and Prior, 2004). Flores (1997) examines the effects on immigration policy of prejudice against immigrants on the part of natives.

The present paper is based in part on an economic theory of regulation, most closely associated with Stigler (1971), Peltzman (1976) and Becker (1983). This method was subsequently extended by Kaempfer and Lowenberg (1988) to the case of trade

imperfectly enforced, which he maintains may be due to political pressure by employer groups and other interests favoring unrestricted entry.

policy.⁷ According to this approach, redistributive regulatory policies are supplied by political-support maximizing politicians who must balance the countervailing pressures exerted by competing interest groups.⁸ In the model developed here, a political market for immigration restrictions arises as a result of the conflicting interests of native owners of inputs that are substitutes in production for inputs supplied by immigrants and native owners of inputs that are complementary in production to immigrant-supplied factor services.

The formation of immigration policy is therefore driven fundamentally by the configuration of domestic interests in favor of, or opposed to, immigration flows to the destination country. The effectiveness of interest groups in producing political influence depends on their ability to overcome free ridership incentives among their members (Olson, 1965). Groups that are most effective in exerting influence are typically those for whom the benefits of collective action are highly concentrated while the costs are widely dispersed among the public at large. Differences in interest group effectiveness are an

⁷ Kaempfer and Lowenberg (1988) focus on international trade sanctions, but their method may be generalized to any form of specific protection.

⁸ Interest group politics will, of course, work very differently and have vastly different effects in different types of institutional and constitutional settings. Many studies have documented the impact of political institutions and constitutional rules on policy outcomes. Thus, for example, Mulligan, Gil and Sala-i-Martin (2004) show that non-democratic societies differ from democracies in terms of the types of policies governing competition for public office. Wintrobe (1998), however, demonstrates that even a dictator is not immune to the pressures of societal groups. A dictator's power is obtained not only through repression of the citizenry but also through the purchase of loyalty. Among democracies there are considerable differences in constitutional forms, e.g., parliamentary versus presidential systems, majoritarian versus proportional representation, etc. Persson and Tabellini (2002, 2003, 2004a, 2004b) find that electoral rules have significant effects on fiscal policy and on the size of government. Specifically, redistributive government spending on social security and welfare, as well as overall government spending, both measured as a percent of GDP, are higher under proportional representation than under majoritarian voting. Total spending by central government, again measured as a share of GDP, is higher under parliamentary than under presidential regimes (Persson, Roland and Tabellini, 2000; Persson, 2002; Persson and Tabellini, 2002, 2004a, pp. 92-93; 2004b). However, parliamentary governments are associated with better economic performance and better growth-promoting policies, such as protection of property rights and freedom of international trade and capital flows, than are presidential governments (Persson and Tabellini, 2003, 2004a, p. 95). Persson (2005) shows that the adoption of pro-growth structural reform policies is most likely in parliamentary systems and under proportional representation. Even cultural differences across countries have been found to play a significant role in shaping economic outcomes (Tabellini, 2005).

important reason for the emergence of socially inefficient policies such as trade protection and immigration restrictions (Becker, 1983, 1985).

Section 2 develops a simple two-sector model of the destination economy to determine the effects of immigration on the returns to native-owned factors that either substitute for, or complement, immigrant labor. Section 3 characterizes a political market for an immigration quota that emerges as a consequence of the conflicting interests of the two groups of native factor suppliers as well as those of other, non-labor market, groups. Section 4 presents a test of the model using data on employment visas issued by U.S. authorities. The results suggest that native labor groups that favor tighter restrictions on employment-based immigration tend to dominate the political process during economic expansions, while factor suppliers favoring looser controls are dominant during contractions. It is also found that technological progress, a growing immigrant community and a larger share of immigrants of European origin result in higher immigration quotas, all else equal. Section 5 summarizes the conclusions.

2. Immigration and Factor Returns

The foregoing literature suggests that immigration policy has distributional effects much like any other restriction on trade or factor flows. In this section we develop a model to identify the effects of immigration on the incomes of substitute and complement factors in the destination economy.

Assume that the destination country consists of two industries, which we call the “substitute” and “complement” industries. Employers in both industries purchase factor services supplied by both natives and immigrants. In the substitute industry immigrant workers are substitutes in production for native workers, whereas in the complement

industry immigrant labor and native labor are complements in production. What the two industries have in common, and hence what leads to a political market for immigration restrictions, is that they both draw immigrant workers from the same labor pool. The size of this immigrant labor pool is exogenous to each industry and is set by politicians.

We assume that immigrant workers can be employed in either industry and can move between industries at zero cost. Thus the jobs available to immigrants in the substitute industry require the same skills, education or experience as do jobs in the complement industry. These jobs could be, for example, primarily low-skilled. However, in the interests of expositional simplicity, we assume zero inter-industry mobility of native workers, i.e., for natives, the skills, education or experience required for employment in the substitute industry are entirely different from those required in the complement industry.

Suppose, for purely illustrative purposes, that the substitute industry is homebuilding and the complement industry is agriculture. In the homebuilding industry natives and immigrants may compete for the same types of construction jobs, e.g., roofing, whereas in agriculture the manual labor services of immigrants complement the services of native workers who operate machinery. Both industries draw immigrants from a common pool of relatively unskilled workers who are employable in either industry. It follows that native roofers, all other things equal, will have an incentive to lobby regulators for tighter restrictions on the size of the common immigrant labor pool, whereas native machine operators in agriculture will have an incentive to lobby for looser restrictions. A political market for restrictions on the size of the common immigrant labor pool is thus formed.

It should be noted that the native-supplied factor in the complement industry is characterized in our model as labor, or human capital, which by virtue of its skills is complementary to unskilled immigrant labor. However, without any loss of generality, the native-supplied complementary factor could just as well be conceived of as physical capital, whose rate of return would be affected in the same way as the skilled wage rate in our model.

The model addresses the following questions: (a) How are the incomes of native workers in the substitute and complement industries affected by changes in the size of the immigrant labor pool? (b) What collectively will native workers in the substitute industry (native workers in the complement industry) be willing to pay for a(n) reduction (increase) in the size of the immigrant pool? And (c) how does the political market set the equilibrium size of the immigrant quota and how is this equilibrium affected by changes in certain exogenous variables? Below we consider each industry separately, then, in Section 3, we bring both industries together in the political market for immigration restrictions.

2A. Equilibrium in the substitute industry's labor market

Suppose that employers in the substitute industry are perfectly competitive in the product and labor markets and use two inputs in production – native labor and immigrant labor. For the sake of simplicity, we abstract from physical capital as an input in the production function. The supply of physical capital can be viewed as fixed, so that the wages of natives and immigrants are not affected by changes in the capital stock. Both types of labor are assumed to be substitute (competitive) inputs in production, meaning that they perform, and hence compete for, the same type of job. When two inputs are substitutes, the marginal product of one input is negatively related to the employment of the other,

hence the demand for one input will be positively related to the market price of the other. If the two inputs were perfect substitutes, employers would hire either only natives or only immigrants, depending on relative wages. However, we want to allow for integration of the labor force, therefore we will assume that, while natives and immigrants are substitutes, they are only imperfectly so.

Imperfect substitutability arises from native/immigrant differences in human capital endowments. For example, the average level of employment experience of workers in the native group may differ from that of workers in the immigrant group. Furthermore, pre-migration employment experience of immigrants may differ from employment experience of natives. There are also likely to be differences between natives and immigrants in terms of the quantity or quality of education, training and language skills.

To capture the feature of imperfect substitutability and to allow for an integrated labor force, we assume that the employer faces the quadratic production function below:⁹

$$(1) Q = \alpha_1 N - \alpha_2 N^2 + \alpha_3 I - \alpha_4 I^2 - \alpha_5 NI ,$$

where Q is output, N is the number of native workers employed, I is the number of immigrant workers employed, and α_1 through α_5 are positive coefficients. The intuition underlying this particular functional form is twofold. First, natives and immigrants perform the same task, but in the execution of the task a native worker's productive contribution differs from that of an immigrant.¹⁰ Second, increasing the usage of workers

⁹ This type of production function can be found in Doll and Orazem (1984, pp. 128-29), who use the example of hay and grain as competitive inputs in the production of milk. Frisch (1965, p. 59) also discusses the case of a quadratic production function in which the interaction term between two inputs is negative. Bodvarsson and Partridge (2001) use a similar equation in a study of black/white salary differentials in the National Basketball Association. In that study, black and white players are treated as imperfect substitutes for the same reason that we treat immigrants and natives as imperfect substitutes in the present model, namely, due to differences in human capital endowments.

¹⁰ Note the expressions for the marginal products:

in one category undermines the efficiency of workers in the other category. This is reflected in the interaction term, α_5 , which measures the impact of a marginal change in the level of employment of one input on the marginal product of the other. The negative sign of this term implies that an increase in the employment of either category of labor reduces the marginal product in the other category. The greater the magnitude of α_5 the greater is the decrease in the marginal product of native (immigrant) labor as a consequence of a unit increase in employment of immigrant (native) labor, i.e., the greater is the degree of substitutability between native and immigrant workers.¹¹ The quadratic production function above was chosen because of these features and for its mathematical simplicity.¹²

Assume a product price of P_S , where the “s” subscript refers to the product sold in the substitute industry. Assume also that each immigrant worker is paid a wage of W_{IS} and that each native worker is paid a wage of W_{NS} . The employer’s profits, π , are thus

$$(2) \pi = P_S[\alpha_1 N - \alpha_2 N^2 + \alpha_3 I - \alpha_4 I^2 - \alpha_5 NI] - W_{NS}N - W_{IS}I.$$

$$\frac{\partial Q}{\partial N} = \alpha_1 - 2\alpha_2 N - \alpha_5 I$$

$$\frac{\partial Q}{\partial I} = \alpha_3 - 2\alpha_4 I - \alpha_5 N$$

According to these expressions, the marginal products can differ for precisely two reasons: (i) the α coefficients can differ, implying technical differences in the inputs themselves; and (ii) the quantities of each input employed can differ.

¹¹ As an example, consider the case of native-born and Mexican-born roofers. While it is not unusual to see members of both groups working together, there could be productive differences between the two. Mexican roofers may have learned slightly different techniques in Mexico for installing a roof than American roofers and their experience levels may differ from those of Americans. Differences in task execution could lead to a situation where increasing the proportion of the roofing team that is Mexican could hamper the efficiency of the proportion that is American. This is analogous to Doll and Orazem’s (1984, pp. 128-29) example of hay and grain being alternative sources of nutrition for dairy cows; if a larger proportion of a cow’s diet consists of hay, that may reduce the nutritional efficacy of grain.

¹² The quadratic production function is one of very few available production functions where two inputs are imperfect substitutes and where it is easy to solve for closed form solutions for the input demand functions. Other functional forms, e.g. the CES, will yield similar comparative statics as those obtained in this paper, but the process of obtaining closed form solutions is much more difficult.

First and second order conditions yield the following demand functions for immigrant (I^D) and native (N^D) labor:

$$(3) I^D = \frac{\frac{1}{\alpha_5}(\alpha_3 - \frac{W_{IS}}{P_S}) + \frac{1}{2\alpha_2}(\frac{W_{NS}}{P_S} - \alpha_1)}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}},$$

$$(4) N^D = \frac{\frac{1}{\alpha_5}(\alpha_1 - \frac{W_{NS}}{P_S}) + \frac{1}{2\alpha_4}(\frac{W_{IS}}{P_S} - \alpha_3)}{\frac{2\alpha_2}{\alpha_5} - \frac{\alpha_5}{2\alpha_4}}.$$

Note that in both demand functions there is a positive relationship between the employment of one input and the price of the competing input, which is consistent with the assumption of imperfect substitutability.

The goal of our analysis is to obtain equilibrium wages for native and immigrant workers and, in particular, to assess the effects of changes in the immigrant quota on native worker incomes. We begin by assuming that there are H employers in the substitute industry and that the supplies of native and immigrant workers to the economy are both perfectly inelastic. The supply of native workers to the substitute industry equals θ_{NS} and the supply of immigrants to the substitute industry is $\lambda\theta_I$, where θ_I is the national supply of immigrants and $\lambda \in [0, 1]$, i.e., λ is the proportion of the national pool of immigrants that is employed in the substitute industry.¹³ It is assumed that λ is exogenously determined, although this assumption is relaxed in the Appendix.

¹³ We do not distinguish between immigrants just entering the destination country's labor market and those who arrived in earlier periods; in this model all immigrants are the same and there is no assimilation, i.e., immigrant skills do not converge toward those of natives with time spent in the host country. A worthwhile extension of the model would be to consider the effects of assimilation on the political market for immigration restrictions.

The condition for market clearing equilibrium in the native labor market in the substitute industry is given by $HN^D = \theta_{NS}$, and the equilibrium condition for the immigrant labor market in the substitute industry is $HI^D = \lambda\theta_I$. Multiplying equation (4) by H and setting this product equal to native labor supply, we solve for the native wage:

$$(5) W_{NS} = \alpha_1 P_S + \frac{\alpha_5 P_S}{2\alpha_4} \left(\frac{W_{IS}}{P_S} - \alpha_3 \right) - \frac{\theta_{NS} \phi \alpha_5 P_S}{H},$$

where

$$\phi = \frac{2\alpha_2}{\alpha_5} - \frac{\alpha_3}{2\alpha_4}.$$

Similarly, multiplying equation (3) by H and setting the product equal to the supply of immigrants, we solve for the immigrant wage:

$$(6) W_{IS} = \left[\frac{\alpha_3}{\alpha_5} + \frac{1}{2\alpha_2} \left(\frac{W_{NS}}{P_S} - \alpha_1 \right) - \frac{\lambda\theta_I \varepsilon}{H} \right] \alpha_5 P_S,$$

where

$$\varepsilon = \frac{2\alpha_4}{\alpha_5} - \frac{\alpha_3}{2\alpha_2}.$$

We then solve for the immigrant wage from the condition for equilibrium in the native labor market:

$$(7) W_{IS} = 2\alpha_4 P_S \left[\frac{W_{NS}}{\alpha_5 P_S} - \frac{\alpha_1}{\alpha_5} + \frac{\alpha_3}{2\alpha_4} + \frac{\theta_{NS} \phi}{H} \right].$$

Setting expression (6) equal to expression (7) and solving for W_{NS} , we obtain the equilibrium native wage:

$$(8) W_{NS} = \frac{P_S \left[2\alpha_4 \left(\frac{\alpha_1}{\alpha_5} - \frac{\alpha_3}{2\alpha_4} - \frac{\theta_{NS} \phi}{H} \right) + \alpha_5 \left(\frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2} - \frac{\lambda\theta_I \varepsilon}{H} \right) \right]}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_3}{2\alpha_2}}.$$

The equilibrium immigrant wage is found by first solving for the native wage from the condition for equilibrium in the immigrant labor market:

$$(9) W_{NS} = \frac{2\alpha_2 P_S \lambda \theta_1 \varepsilon}{H} - \frac{2\alpha_2 P_S}{\alpha_5} \left(\alpha_3 - \frac{W_{IS}}{P_S} \right) + \alpha_1 P_S.$$

Setting expression (5) equal to expression (9) and solving for W_{IS} , we obtain the equilibrium immigrant wage:

$$(10) W_{IS} = \frac{\frac{2\alpha_2 \alpha_3}{\alpha_5} - \frac{\alpha_3 \alpha_5}{2\alpha_4} - \frac{1}{H} (\theta_{NS} \phi \alpha_5 + 2\alpha_2 \lambda \theta_1 \varepsilon)}{\frac{2\alpha_2}{\alpha_5 P_S} - \frac{\alpha_5}{2\alpha_4 P_S}}.$$

Equations (8) and (10) indicate that the wages of both native and immigrant labor in the substitute industry depend on the strength of consumer demand, P_S , the supply of native workers to the industry, θ_{NS} , the national supply of immigrant workers, θ_1 , the size of the industry, H , the share of the immigrant workforce employed in the industry, λ , the degree of competitiveness between the two categories of labor, α_5 , as well as other parameters of the production function. Of most interest here is the marginal effect of the size of the immigrant pool on the native worker's wage, which may be obtained by partially differentiating expression (8) with respect to the immigrant pool:

$$(11) \frac{\partial W_{NS}}{\partial \theta_1} = - \frac{\frac{\alpha_5 P_S \varepsilon \lambda}{H}}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}} < 0.$$

As intuition would suggest, an increase in the immigrant labor pool unambiguously harms the native worker by lowering his wage. This is clearly a result of the competitive nature of the native and immigrant labor forces in production. When more immigrants

are allowed into the country the immigrant wage drops, which induces employers to substitute immigrants for natives, leading to a fall in the native worker's wage.

The sensitivity of the native worker's wage to a change in the immigrant pool depends on a number of important factors. First, native wages will be more sensitive to the immigrant pool the greater is the product price:

$$(12) \frac{\partial^2 W_{NS}}{\partial \theta_1 \partial P_s} = - \frac{\frac{\alpha_5 \varepsilon \lambda}{H}}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}} < 0.$$

If the immigrant pool rises, the native worker's wage will fall by more if the product price is relatively high than if the product price is relatively low. However, the marginal effect of the immigrant pool on the native worker's wage will be smaller, i.e., less negative, the greater is the number of employers, i.e.,

$$(13) \frac{\partial^2 W_{NS}}{\partial \theta_1 \partial H} = \frac{\frac{\alpha_5 P_s \varepsilon \lambda}{H^2}}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}} > 0.$$

Finally, the immigrant labor pool will have more "sting" on native workers the greater is the degree of substitutability between native and immigrant workers (the higher is α_5) and the greater is the proportion of the immigrant pool that is employed in the substitute industry, λ .

How much will native workers as a group be willing to pay for a reduction in the size of the immigrant labor pool? If the group faces a cost of lobbying politicians for relief from having to compete with immigrant workers, then the group's willingness to pay for a unit reduction in the immigrant pool should equal the gain in the group's

income from a smaller immigrant pool less the marginal cost of lobbying for regulatory relief:

$$(14) \left[\frac{\alpha_5 P_S \lambda \varepsilon}{2\alpha_4 - \frac{\alpha_5}{2\alpha_2}} \right] \theta_{NS} - C_S \theta_{NS} ,$$

where C_S is the cost to the group of having each member participate in lobbying for a reduction in the immigrant pool. Lobbying costs could come in various forms. For example, the group might need to provide financial support to a candidate for political office who is campaigning for tighter immigration restrictions, hence C_S could be the required contribution of each member. As another example, the group might have to charge each member a fee to cover the costs of advertising to the general public on the need for and importance of immigration restrictions. Finally, C_S could be the cost to the group of motivating each member to participate in a collective effort to obtain regulatory relief. The group might have to expend resources on monitoring to prevent free riding by group members in the lobbying effort. Free riding normally increases with the size of the group. Groups that are less politically effective would be those that face higher monitoring costs.

The native worker group will lobby for a reduction in the immigrant labor pool if the aggregate marginal benefit of a reduction in the pool exceeds the aggregate marginal cost, i.e., if the first term in equation (14) exceeds the second term. If this condition is met, then since neither term in equation (14) depends on the stock of immigrant labor, the demand curve for regulatory relief will be perfectly elastic, i.e., the group's willingness to pay for a unit increase in immigration restrictions will be constant and the group will

lobby for a 100 percent reduction in the immigrant quota.¹⁴ The reason that the aggregate marginal benefit of regulatory relief is constant is that the native wage in equation (8) is linearly related to the supply of immigrant workers, i.e., the native wage falls by the same amount for every unit increase in immigration. Equation (14) also suggests that, *ceteris paribus*, the willingness to pay for regulatory relief will be greater the greater is the strength of customer demand for the industry's product (the higher is P_S), the greater is the degree of competitiveness between immigrant and native workers, α_5 , the lower is the cost of having each member of the native worker group participate in a lobbying effort, C_S , the greater is the size of the native worker group, $\psi\theta_N$, and the smaller is the number of employers, H .

2B. Equilibrium in the complement industry's labor market

In the complement industry, natives and immigrants perform different jobs that complement one another in production. In this industry, an increase in immigrant (native) workers augments the marginal product of native (immigrant) workers. Assume that employers in this industry use two inputs in production – native workers and immigrant workers. As in the case of the substitute industry, we abstract from physical capital as a separate input in the production function although, as mentioned above, the factor supplied by natives to the complement industry can be conceived of as either human or physical capital. Again we assume that employers are perfectly competitive in the product and labor markets. To capture the feature of complementarity between native and immigrant workers in production, we use a Cobb-Douglas production function:

¹⁴ The model could easily be modified to allow for an interior solution for lobbying effort in the substitute industry, e.g., by allowing for diminishing marginal benefits from regulatory relief and/or increasing marginal costs of lobbying for relief. However, we have chosen not to do this in order to keep the mathematics of the model as simple as possible. As will be seen, we do allow for an interior solution in the

$$(15) Q = A(N)^\beta(I)^\delta,$$

where Q is output, N is the number of native workers employed, I is the number of immigrant workers employed, $\beta + \delta < 1$ and $A > 0$. The parameters β and δ together reflect how much an increase in the employment of either category of labor enhances the marginal product of the other category. The greater the magnitude of β and δ the greater is the increase in the marginal product of native (immigrant) labor as a consequence of a unit increase in employment of immigrant (native) labor, i.e., the greater is the degree of complementarity between native and immigrant workers.

Assume a product price of P_o , where the “o” subscript refers to the complement industry. Assume also that each immigrant worker is paid a wage of W_{IO} and each native worker is paid a wage of W_{NO} . The employer’s profits, π , are:

$$(16) \pi = P_o[A(N)^\beta(I)^\delta] - W_{NO}N - W_{IO}I.$$

First and second order conditions yield the following demand functions for native (N^D) and immigrant (N^I) labor, respectively:

$$(17) N^D = \left(\frac{\beta}{W_{IO}}\right)^\gamma \left(\frac{\delta}{W_{NO}}\right)^{\frac{1-\beta}{\gamma}} (P_o A)^\gamma,$$

$$(18) I^D = \left(\frac{\beta}{W_{IO}}\right)^{\frac{1-\delta}{\gamma}} \left(\frac{\delta}{W_{NO}}\right)^{\frac{\delta}{\gamma}} (P_o A)^\gamma,$$

where $\gamma = 1 - \delta - \beta$. Note that, in contrast to the substitute industry, in both demand functions there is a negative relationship between the employment of one input and the price of the other input, which is consistent with the underlying assumption of complementarity in production.

complement industry. Our model yields comparative static results for the equilibrium quota as long as at least one of the industries is characterized by an interior solution for lobbying effort.

Assume that there are F employers in the complement industry. The supply of native workers to the complement industry equals θ_{NO} and the supply of immigrant workers to the industry is $(1-\lambda)\theta_I$. Using the same method as was used earlier to derive the equilibrium native and immigrant wages in the substitute industry (expressions (8) and (10), respectively), the equilibrium native and immigrant wages in the complement industry are as follows:

$$(19) W_{NO} = \frac{\beta AF^\gamma (1-\lambda)\theta_I^\delta P_o}{(1-\psi)\theta_N^{1-\beta}}$$

$$(20) W_{IO} = \frac{\delta AF^\gamma (1-\psi)\theta_N^{\frac{\beta(1-\delta)}{\gamma}} P_o}{(1-\lambda)\theta_I^{1-\delta}}$$

In equilibrium, the native wage in the complement industry is positively related to the size of the industry, F, the size of the national pool of immigrant workers, θ_I , the share of this pool employed in the industry, $(1-\lambda)$, and the product price, P_o , but negatively related to the size of the national pool of native workers, θ_{NO} . The immigrant wage is positively related to industry size, the product price and the national pool of native workers, but negatively related to the national pool of immigrants.

Because native and immigrant workers are complementary inputs, native workers ultimately benefit from a larger pool of immigrant workers. Specifically, the marginal effect of the national immigrant quota on the native wage is positive, but diminishing:

$$(21) \frac{\partial W_{NO}}{\partial \theta_I} = \frac{\delta \beta AF^\gamma (1-\lambda)\theta_I^{\delta-1} P_o}{\theta_{NO}^{1-\beta}} > 0$$

$$(22) \frac{\partial^2 W_{NO}}{\partial \theta_I^2} = \frac{(\delta-1)\delta \beta AF^\gamma (1-\lambda)\theta_I^{\delta-2} P_o}{\theta_{NO}^{1-\beta}} < 0.$$

Furthermore, the marginal effect of the immigrant workforce on the native wage will be stronger the greater is customer demand for the product:

$$(23) \frac{\partial^2 W_{NO}}{\partial \theta_I \partial P_o} > 0,$$

and the greater is the number of employers:

$$(24) \frac{\partial^2 W_{NO}}{\partial \theta_I \partial F} > 0,$$

but it will be smaller the larger is the native workforce:

$$(25) \frac{\partial^2 W_{NO}}{\partial \theta_I \partial \theta_N} < 0.$$

Native workers clearly have an incentive to lobby politicians for a loosening of immigration restrictions. How much will these workers as a group be willing to pay for an increase in the size of the national immigrant labor pool? If the group faces a cost of lobbying regulators for looser restrictions, then the group's willingness to pay for a unit increase in the immigrant quota should equal the gain in the group's income from a larger immigrant pool less the marginal cost of lobbying for regulatory relief:

$$(26) \left(\frac{\delta \beta A F^\gamma (1 - \lambda) \theta_I^{\delta-1} P_o}{\theta_{NO}^{1-\beta}} \right) \theta_{NO} - C_o \theta_{NO},$$

where C_o is the per-member lobbying cost. The native worker group will lobby for an increase in the immigrant labor pool if the aggregate marginal benefit of a bigger pool, i.e., the first term in equation (26), exceeds the aggregate marginal cost. Since, as indicated in equation (22), the marginal effect of the immigrant quota on the native wage diminishes, native workers will experience diminishing marginal benefits from reduced restrictions. Conversely, they will experience *increasing* marginal losses from a

tightening of restrictions. In other words, the native worker group will be willing to pay incrementally larger amounts to not have a tightening of restrictions.

3. The Political Market for Immigration Restrictions

The above analysis demonstrates that there are two groups organized along labor market lines in the destination country that will have conflicting interests regarding restrictions on immigration: (i) native workers in the substitute industry who prefer tighter restrictions; and (ii) native workers, or more generally factor suppliers, in the complement industry who prefer looser restrictions.¹⁵ It is very likely that other groups, organizing along non-labor market lines, will also help to shape immigration policy. For example, groups promoting social and cultural diversity, or groups of earlier immigrants desiring close ties to family and friends left behind in the source countries, may lobby for looser restrictions on immigration. In contrast, other groups opposed to immigration on non-economic grounds may lobby for tighter restrictions.¹⁶ Provided that for some non-trivial level of restrictions, the willingness to pay for a unit increase in restrictions exceeds the willingness to pay for a unit decrease in restrictions, there will emerge a

¹⁵ While not included in the model, there are other potential influences on the political market for immigration restrictions originating from the two industries. First, there is the possibility that previous immigrants employed in the substitute industry may, along with natives, lobby to keep their brethren out of the host country. Second, previous immigrants employed in the complement industry may join their native colleagues in lobbying for looser immigration restrictions. Finally, with the increasing globalization of international labor markets, it has become more common for traditional host countries to outsource production to those countries that have traditionally supplied immigrant labor, e.g., outsourcing of production to India by software makers in the U.S., Canada and Western Europe. One would expect outsourcing to change the incentives to lobby for more immigrants held by native workers in the complement industry. While our model does not allow for these additional influences on the political market for immigration restrictions, these are worthwhile extensions of the analysis.

¹⁶ These groups may, for example, promote cultural homogeneity or argue that immigrants contribute to higher crime rates and social unrest or take more from public services than they contribute to tax revenue. Some may believe that immigration creates a national security risk in a post-9/11 world.

political market for restrictions comprising a wide spectrum of groups organized along both labor market and non-labor market lines.

In this section, we develop a model of the market for restrictions and derive from it a number of testable hypotheses. Included in the political model are some of the partial equilibrium expressions from each industry obtained above. In the political market, there will be a demand for more restrictions on the part of native workers in the substitute industry and other groups who favor tighter restrictions on social or political grounds. In contrast, there will be a demand for fewer restrictions on the part of native workers in the complement industry and other groups who favor looser restrictions for non-economic reasons.

The demand for more restrictions stems from two sources: (i) the aggregate willingness to pay by the substitute industry's native workers for a unit decrease in the immigrant workforce, reflected in expression (14); and (ii) the aggregate willingness to pay by anti-immigrant groups who are organized along non-labor market lines. With the first group, recall that native workers in the substitute industry will display constant willingness to pay for a unit increase in restrictions, i.e., the demand curve for restrictions is perfectly elastic. With respect to the second group, assume that χ is the fraction of the destination country's population consisting of persons advocating restrictions for non-economic reasons, POP is that country's population, Ω is each group member's marginal valuation of a unit reduction in the immigrant workforce and C^* is the cost to each group member of lobbying. It follows that the group's willingness to pay for a unit reduction in the immigrant workforce equals $\chi\text{POP}(\Omega - C^*)$. Combining both groups, the aggregate willingness to pay for a unit increase in restrictions equals:

$$(27) \left[\frac{\frac{\alpha_5 P_S \lambda \varepsilon}{H}}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}} \right] \theta_{NS} - C_S \theta_{NS} + \chi POP(\Omega - C^*)$$

The demand for fewer restrictions is partly reflected in expression (26), the aggregate willingness to pay by the complement industry's native workers for a unit increase in the immigrant workforce. Recall that native workers in the complement industry will display diminishing marginal willingness to pay for a unit decrease in restrictions, i.e., the demand curve for fewer restrictions is downward sloping. This demand curve is, in essence, the politicians' supply curve for *more* restrictions. Native factor suppliers in the complement industry are made worse off by greater restrictions. This negative effect of restrictions on their incomes creates an incentive for them to engage in political activity which imposes costs on the politicians supplying the restrictions. These costs could come, for example, in the form of increased support for opposition candidates or various forms of protest ranging from non-violent dissent to civil disobedience. The demand price for reduced levels of restrictions on the part of native factor suppliers in the complement industry is therefore also the politicians' supply price of increases in restrictions. The supply curve slopes upward because increases in restrictions will cause increasing losses at the margin for those made worse off.

Outside of the labor market, there will be other groups favoring looser restrictions on non-economic grounds. The most likely and visible of these is the immigrant community in the destination country. For example, immigrants from a particular country often tend to lobby for more immigration from that country; looser restrictions make it easier for friends and family back home to seek admission to the host country, as well as for the immigrant enclave in the destination country to be strengthened. To

capture this effect on the market for restrictions, we assume that the willingness to pay for looser restrictions by the immigrant community is positively related to its size and that the cost of lobbying per community member is C_{IP} , where the “IP” notation stands for past immigrant. Accordingly, the aggregate willingness to pay for a unit increase in the immigrant workforce will equal the sum of the willingness to pay by the native labor pool in the complement industry and the willingness to pay by previous immigrants:

$$(28) \left(\frac{\delta\beta AF^\gamma (1-\lambda)\theta_I^{\delta-1} P_o}{\theta_{NO}^{1-\beta}} \right) \theta_{NO} - C_o \theta_{NO} + \theta_{IP} (\rho - C_{IP})$$

where θ_{IP} is the size of the immigrant community in the host country and ρ is a parameter reflecting each immigrant’s valuation of an additional compatriot entering the country.

The support maximizing politician sets the quota for the number of immigrant workers to be admitted to the destination country, θ_I . He will set the quota at a level where the pressure for tighter restrictions on immigration at the margin is offset by the marginal pressure against tighter restrictions. At the equilibrium level of θ_I , the willingness to pay for reducing the immigrant quota by one unit (equation (27)) just equals the willingness to pay to not have a unit decrease in the quota (equation (28)).

Accordingly, the politician equates expressions (27) and (28),

$$(29) \left[\frac{\frac{\alpha_5 P_s \lambda \varepsilon}{2\alpha_4 - \alpha_5}}{\alpha_5 - 2\alpha_2} \right] \theta_{NS} - C_s \theta_{NS} + \chi POP(\Omega - C^*) = \left(\frac{\delta\beta AF^\gamma (1-\lambda)\theta_I^{\delta-1} P_o}{\theta_{NO}^{1-\beta}} \right) \theta_{NO} - C_o \theta_{NO} + \theta_{IP} (\rho - C_{IP})$$

and solves for the equilibrium quota:

$$(30) \theta_I = \left[\frac{\frac{\alpha_5 \lambda \varepsilon P_s \theta_{Ns}}{2\alpha_4 - \alpha_5} - C_s \theta_{Ns} + \chi POP(\Omega - C^*) + C_o \theta_{No} - \theta_{IP}(\rho - C_{IP})}{\frac{\alpha_5}{2\alpha_2} A(1 - \lambda) \beta \delta F^\gamma P_o \theta_{No}^\beta} \right]^{\frac{1}{\delta-1}}$$

The equilibrium quota depends on product prices, the supplies of native workers to both industries, the size of each industry, the size of the immigrant community, lobbying costs, the value a member of the immigrant community (member of the anti-immigrant group) places on a bigger (smaller) immigrant quota and the size of the group advocating restrictions on non-economic grounds. In addition, the equilibrium quota depends upon various technological parameters, including the degree of competitiveness between native and immigrant workers in the substitute industry, α_5 , and the degree of complementarity between native and immigrant workers in the complement industry.

Below are assorted comparative static results. Formal proofs are available from the authors on request.

1. *When customer demand in the substitute industry rises (falls), restrictions on immigration rise (fall), i.e., $\partial\theta_I/\partial P_s < 0$.*

When the product price in this industry rises, the marginal revenue product (MRP) of native workers increases, and so does the group's willingness to pay for tighter restrictions. Willingness to pay rises because, now that the MRP is higher, the losses to native workers that would be suffered from increased immigration to the industry are greater. As indicated in expression (12), the marginal effect of an increase in the immigration quota on native wages increases, i.e., becomes more negative, as the product

price rises, thereby creating a greater incentive for native workers to oppose immigration. In contrast, when customer demand weakens, the losses that would be suffered by native workers from increased immigration are lower, reducing the benefits from lobbying for tighter restrictions and resulting in a higher equilibrium quota.

2. *When customer demand in the complement industry rises (falls), restrictions on immigration fall (rise), i.e., $\partial\theta_1/\partial P_o > 0$.*

A higher product price in the complement industry boosts the MRP of native workers and, as indicated in expression (23), increases the marginal effect of a rise in the immigrant labor pool on the native wage. Therefore an increase in the product price causes an increase in the gains that native workers in the complement industry enjoy from immigration. The native group's willingness to pay for looser restrictions increases, resulting in a higher immigrant quota, all other things equal. In contrast, if customer demand weakens, the benefits to lobbying for greater immigration decrease because potential gains from increased immigration are lower. *Ceteris paribus*, a smaller equilibrium quota results.

3. *An increase (decrease) in the size of the substitute industry will lead to a loosening (tightening) of immigration restrictions, i.e., $\partial\theta_1/\partial H > 0$.*

An increase in the number of employers in the substitute industry will have two positive effects on native workers. First, the demand for labor will rise and push up the native wage. Second, the native wage will become less sensitive to a change in the supply of immigrant labor. As indicated in expression (13), an increase in the number of employers in the substitute industry causes the marginal effect of immigration on native wages to become less negative. Essentially, when there are more employers bidding for the

services of a fixed stock of native workers, increased immigration becomes economically less relevant to those workers. Therefore the benefits of lobbying for tighter immigration restrictions are reduced, resulting in a larger equilibrium quota, *ceteris paribus*. In contrast, when the substitute industry is relatively small, the marginal loss to each native worker from increased immigration is greater. Consequently there will be a greater incentive to lobby for tighter restrictions, resulting in a smaller equilibrium quota, all other things equal.

4. *An increase (decrease) in the size of the complement industry will lead to a larger (smaller) immigrant quota, i.e., $\partial\theta_I/\partial F > 0$.*

Expansion of the complement industry will have the same effect on the quota as will an expansion of the substitute industry, but for a different reason. When there are more employers in the complement industry, native wages not only rise, but become more sensitive to a change in immigration. Expression (24) indicates that the marginal effect of an increase in immigration on the native wage becomes larger with an increase in the number of employers in the complement industry. Therefore the gains that each native worker would enjoy from increased immigration will rise. The native worker group will have stronger incentives to lobby for looser restrictions. In contrast, when the industry is relatively small, the marginal effect of immigration on the native wage is smaller. The benefits of lobbying for looser restrictions will thus be lower, leading to a smaller immigrant quota.

5. *An increase in the substitute industry's native workforce could result in tighter immigration restrictions, but could also result in looser restrictions, depending on how politically effective that group is, i.e., the sign of $\partial\theta_I/\partial\theta_{NS}$ is indeterminate.*

The marginal effect of the native workforce on the equilibrium quota is:

$$(31) \frac{\partial \theta_I}{\partial \theta_{NS}} = \frac{1}{\delta - 1} \left[\frac{\frac{\alpha_5 \lambda \varepsilon P_s \theta_{NS}}{H} - C_s \theta_{NS} + \chi POP(\Omega - C^*) + C_o \theta_{No} - \theta_{IP}(\rho - C_{IP})}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}} \frac{1}{A(1-\lambda)\beta\delta F^\gamma P_o \theta_{No}^\beta} \right]^{\frac{1}{\delta-1}} x$$

$$\left[\frac{\frac{\alpha_5 \lambda \varepsilon P_s}{H} - C_s}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}} \frac{1}{A(1-\lambda)\beta\delta F^\gamma P_o \theta_{No}^\beta} \right]$$

The sign of expression (31) is ambiguous. While the first bracketed expression on the right-hand side of (31) is negative, the second bracketed expression could be positive or negative. For example, if the native worker group faces a very high cost of inducing each of its members to participate in a lobbying effort, i.e., if C_s is very large, then an increase in the native workforce would actually lead to less lobbying effort and a larger immigrant quota. On the other hand, if the lobbying group faces relatively low monitoring costs, i.e., if it is relatively effective politically, a swelling of the native workforce would result in greater lobbying effort and tighter immigration restrictions.

6. *An increase in the complement industry's native workforce could result in looser immigration restrictions, but could also result in tighter restrictions, depending on how politically effective that group is, i.e., the sign of $\partial\theta_I/\partial\theta_{No}$ is indeterminate.*

This result is similar to the preceding one. If the native workforce is relatively effective politically, i.e., if C_0 is relatively low, an increase in the native workforce will increase the net benefits of lobbying and result in a larger immigrant quota. On the other hand, if it is relatively expensive for the group to monitor each of its members in the political arena, the net benefits to lobbying will fall when the native workforce expands, resulting in tighter immigration restrictions.

7. When native and immigrant workers become more (less) competitive in production, there will be tighter (looser) restrictions on immigration, i.e., $\partial\theta_1/\partial\alpha_5 < 0$.

Recall from equation (1) that α_5 is the coefficient of the interaction term in the production function confronting firms in the substitute industry. When this parameter rises, a unit increase in immigrant employment will cause a larger decrease in the marginal product of native labor. Thus when α_5 goes up, the losses to native workers from increased immigration will be larger and their willingness to pay for tighter restrictions will rise. The support maximizing politician will respond by reducing the immigrant quota. This prediction has a broader implication, namely, that in those countries and industries where native and immigrant workers are more similar with respect to skills and productivity, natives will invest more resources in lobbying for less immigration and immigration restrictions will be tighter. However, when the degree of substitutability between native and immigrant workers is smaller, immigration restrictions will be looser.

8. When the degree of complementarity between native and immigrant workers rises (falls), there will be looser (tighter) immigration restrictions, i.e., $\partial\theta_1/\partial\beta$ and $\partial\theta_1/\partial\delta > 0$.

Recall from equation (15) that the β and δ parameters reflect the sensitivity of the marginal product of one category of labor in the complement industry to an increase in

the employment of the other category. Thus, for example, the greater the values of β and δ the larger is the increase in the marginal product of native labor that is induced by a unit increase in immigration. Native workers will have a greater incentive to lobby for looser immigration restrictions, resulting in a higher immigrant quota. There is a broader implication here too, namely, that politicians in the destination country will apply larger immigration quotas to those countries that export workers whose skill levels most closely complement those of native workers. Conversely, of course, if the degree of complementarity between native and immigrant labor is smaller, native workers in the complement industry will have less incentive to lobby for looser immigration restrictions, and the equilibrium quota will be smaller.

9. The greater is the proportion of the immigrant workforce that is employed in the substitute (complement) industry, the tighter (looser) will be immigration restrictions, i.e., $\partial\theta_I/\partial\lambda < 0$. When the substitute industry's share of the immigrant pool rises, native wages fall and the negative marginal effect of immigration on native wages increases. This bolsters the willingness to pay for tighter restrictions on the part of substitute industry native labor, resulting in a smaller equilibrium quota. On the other hand, if the proportion of the immigrant pool employed in the complement industry, $(1-\lambda)$, rises, native wages increase and the positive marginal effect of immigration on native wages rises. This increases the willingness to pay for looser restrictions by native factor owners in the complement industry, resulting in a larger immigration quota. Thus far we have treated the immigrant employment shares in each industry, λ and $(1-\lambda)$, as exogenous. In a general equilibrium setting, however, these shares will be endogenous. In the Appendix we derive a general equilibrium expression for λ .

10. *The greater (smaller) are the wage elasticities of demand for native and immigrant labor in the substitute industry, the looser (tighter) will be immigration restrictions*, i.e., $\partial\theta_1/\partial\alpha_2$ and $\partial\theta_1/\partial\alpha_4 < 0$. The parameters α_2 and α_4 are part of the production function facing employers in the substitute industry – see equation (1). The bigger is α_2 (α_4) the more steeply the demand curve for native (immigrant) labor slopes downward. Conversely, the smaller are these parameters the more elastic are the demand curves for each category of labor. When α_2 and α_4 are relatively small, i.e., when labor demand in the substitute industry is relatively wage elastic, increased immigration will have a relatively minor negative effect on native wages. Consequently, immigration quotas will be economically less relevant to the native worker group and therefore the group's willingness to pay for reduced immigration will be lower. Politicians will set a larger equilibrium quota. In contrast, when labor demand is less wage elastic, i.e., when α_2 and α_4 are larger, increased immigration inflicts more harm on native workers and they will be willing to pay more for reduced immigration. The equilibrium quota will then be smaller. This prediction suggests a potentially important link between technology and immigration policy outcomes. Suppose, for example, that technological change results in an increase in the wage elasticities of demand for native and/or immigrant labor. A technical change of this nature will ultimately result in a loosening of immigration restrictions.

Finally, when we consider lobbying groups organized along non-labor market lines, there are some additional predictions of interest: (1) the larger is the anti-immigrant group, the smaller is the immigrant quota ($(\partial\theta_1/\partial(\chi\text{POP})) < 0$); and(2) the larger is the

immigrant community in the destination country, the larger is the immigrant quota $(\partial\theta_I/\partial\theta_{IP}) > 0$.

4. A Test of the Equilibrium Quota Model

The model developed above suggests that the equilibrium immigrant quota will be determined by conditions within the substitute and complement industries (customer demand, the size of the native-born labor force, the number of firms, the costs of native-born workers lobbying their politicians, and technology), as well as by the share of the destination country's population opposed to immigration on non-economic grounds, by anti-immigrant group members' marginal valuation of a reduction in the immigrant workforce, and by the size of the immigrant community. In this section, we present a test of the main predictions implied by equation (30) using annual U.S. data from 1954 to 2002.

There are several ways in which the dependent variable, the equilibrium immigrant quota, could be measured. One approach is to treat this variable as a strict legislated quota, e.g., the maximum number of employment visas that Congress allows immigration authorities to issue each year. The drawback to this method is that, while there have been legislated caps on immigrant admissions since the Quota Act of 1921, they have been altered relatively infrequently and by relatively small amounts. An alternative approach, and the one used here, is to treat the dependent variable as the actual number of admissions, while at the same time controlling for changes in the official quota over time. The advantage of this method is that there are annual data on admissions, including those specifically for employment purposes, and there has been substantial variation in

employment admissions over time. In fact, immigration authorities have been reporting employment-specific admissions annually since 1954, allowing for a sufficiently long time series study.

The real challenge to the estimation of equation (30) is twofold. First, it is very difficult to obtain meaningful economy-wide empirical counterparts for some of the right-hand side variables, especially lobbying costs. Second, it is very difficult to distinguish empirically between substitute and complement industries. An ideal test would be, for example, to exploit some special case involving two industries for which there is prior evidence that immigrants and natives are substitutes in the one and complements in the other. However, such prior information is very difficult to obtain and would, at best, be anecdotal. In the absence of such industry-specific evidence, we chose to treat the labor market as a national market for all industries combined. Consequently, the reported coefficient estimates are to be interpreted as reflecting the aggregate *net* effects of lobbying for and against immigration restrictions.

The dependent variable used in our regressions is the number of employment visas issued per year by federal authorities. Visa data were obtained from the *Yearbook of Immigration Statistics*, formerly entitled *Statistical Yearbook of the Immigration and Naturalization Service*, published by the U.S. Bureau of Citizenship and Immigration Services (BCIS) which is now part of the U.S. Department of Homeland Security and is the successor to the Immigration and Naturalization Service, which was part of the U.S. Department of Justice. Visa data from 1995 to 2002 were obtained from the BCIS's website (<http://uscis.gov/graphics/shared/aboutus/statistics/index.htm>), while data for

earlier years were obtained from the *Statistical Yearbook*.¹⁷ In constructing the dependent variable, we excluded spouses and children of individuals who were admitted to the U.S. on the basis of employment preferences. This allows for a relatively precise measure of immigrant workers admitted to the labor market.

Figure 1 shows the number of employment visas issued annually since 1954. There were spikes in employment-based admissions beginning in the mid 1960s, in the early 1990s and then shortly before the new millennium began. The first spike, although relatively small, clearly coincided with the 1965 amendment to the Immigration and Nationality Act, while the second spike coincided with the addition of the new employment preferences in 1992. The spike beginning around 2000 coincided primarily with increases in the number of aliens who were allowed to receive H1-B visas. The numerical limitation on H1-B visas was temporarily raised from 65,000 to 195,000 in fiscal years 2001, 2002 and 2003. In fiscal year 2004, the limitation was reduced back to 65,000.

(Figure 1 goes here)

¹⁷ It should be noted that since 1954, the rules, or what are known in the immigration policy community as “preferences,” allowing for the issuance of employment visas, have changed. Up through the first part of 1965, only immigrants with special skills, those who at the time were referred to as “first preference” immigrants, were issued employment visas. Few immigrants satisfied this criterion, hence admissions were typically quite low. When the Immigration and Nationality Act was amended in 1965, two more categories/preferences were created, which had the effect of increasing substantially the number of employment visas issued. In addition to the first preference, members of the professions of exceptional ability (“third preference”) and workers in skilled or unskilled occupations that were in short supply (“sixth preference”) became candidates for employment visas. In 1992 the employment preference classification system changed again. Effective that year, Congress created a specific set of five employment-based preferences. These were: (1) aliens with extraordinary ability; (2) professionals holding advanced degrees; (3) skilled and unskilled workers; (4) special immigrants, which included ministers, employees of the U.S. government abroad, certain former employees of the Panama Canal Company and Canal Zone Government, retired employees of international organizations, aliens serving in the U.S. armed forces and religious workers; and (5) immigrants admitted through special employment creation programs. As with the changes in the preference system in 1965, the 1992 changes had the effect of making more immigrants eligible for admission to the U.S. on employment grounds.

The following measures of the right-hand side variables in equation (30) are used in the regression analysis:

(i) The strength of customer demand in each industry, P_s and P_o , is measured by annual real GDP for the U.S. Since real GDP indicates the overall level of business activity, we also use it to proxy the sizes of the substitute and complement industries (H and F, respectively). GDP data were obtained from the FRED database at the Federal Reserve Bank of St. Louis's website (www.stls.frb.org);

(ii) The stocks of native labor in each industry, θ_{NS} and θ_{NO} , are proxied by the number of native-born persons residing in the U.S. each year, which we also use to measure the size of the group lobbying for tighter immigration restrictions on non-economic grounds, χPOP . Here we assume, in effect, that the percentage of the native-born population that is anti-immigrant for non-economic reasons is constant over time, so that the size of the anti-immigrant group is proportional to the native-born population.¹⁸ The size of the immigrant population, θ_{IP} , is measured by the number of foreign-born persons residing in the U.S. each year. The data on native-born and foreign-born persons are from the decennial census and were obtained from the U.S. Census Bureau's website (www.census.gov);¹⁹

¹⁸ Due to lack of available data, we were unable to include in our regressions an empirical counterpart for λ , the proportion of the immigrant labor pool that is employed in the substitute industry.

¹⁹ The Census Bureau, as part of its March *Current Population Survey*, recently began collecting data on the native/foreign-born breakdown of the civilian labor force. These data would have been preferred to general population data because they are annual and are more accurate measures of the native labor stock. However, because they are only available since 1995, there are too few observations to allow for meaningful coefficient estimates. For this reason, we chose to use the number of native-born members of the general population on the grounds that changes in that number over time should be highly correlated with changes in the number of native-born members of the civilian labor force. Furthermore, we did not include in our regressions a separate measure of U.S. population (the POP variable in the theoretical model), as population is already accounted for by its two components, native-born and foreign-born persons.

(iii) Each lobbying group member's marginal valuation of tighter immigration restrictions, Ω , is assumed to vary inversely with the degree of ethnic diversity²⁰ in the U.S. population and positively with the national unemployment rate. We measure ethnic diversity by the percentage of the foreign-born population that is non-white. The rationale here is that, since the primary source of change in the U.S.'s ethnic diversity is international migration, when immigrants come from a wider variety of countries and cultures the share of the immigrant pool that is non-white will tend to rise. We hypothesize that an ethnically diverse population will be less hostile to new arrivals from varying cultural backgrounds than will an ethnically homogeneous population. When the national unemployment rate rises, we assert that there will be increased anti-immigrant sentiment, reflected in more persons choosing to lobby in favor of tighter restrictions;

(iv) Lobbying costs incurred by native workers in each industry, C_s and C_o , are measured by total union membership in the U.S. Our rationale here is that much of the lobbying over immigration restrictions is likely to involve labor unions. Organized labor is one of the interest groups most affected by changes in factor incomes caused by loosening or tightening of immigration regulations. As union membership rises, lobbying costs will rise *ceteris paribus*, due to increased levels of free riding among union members and consequently increased costs of organizing and monitoring collective action. Data on total union membership were obtained from various editions of the *Handbook of Labor Statistics*, published by the Bureau of Labor Statistics, as well as from various editions of the *Statistical Abstract of the United States*;

²⁰ The populations of destination countries differ from one another with respect to ethnic and cultural diversity, which is likely to affect immigration quotas. For example, Canada, considered a relatively multicultural nation, historically has experienced high rates of international in-migration. In contrast, Japan, which historically has valued cultural homogeneity, takes in very few immigrants. The point is that

(v) Lobbying costs confronting groups organized along non-labor market lines are proxied by a dummy variable that controls for changes in the general political climate of the country. If the political climate becomes less friendly to immigrants, it will become less (more) costly for anti-immigrant (pro-immigrant) groups to successfully lobby their politicians. The dummy takes a value of one if a Democratic president occupied the White House, zero otherwise;

(vi) The technological parameters in equation (30) are proxied by an annual index of labor productivity, specifically output per hour of all persons employed in the business sector. This index, which equals 100 for 1992, was obtained for the years 1954-58 from the *Statistical Abstract of the United States*²¹ and for remaining years from the *Economic Report of the President*.

We hypothesize that the level of immigration restrictions will be driven by several other factors. First, the demand for employment visas for persons originating from Europe have been declining relative to visa demand from other parts of the world since the 1950s. In fact, prior to 1965, when immigration legislation generally favored Europeans, many European country quotas were not met each year. However, during the same period there was usually excess demand for employment visas for persons coming from Asia and Latin America. Therefore, the political market for restrictions may have been influenced during our sample period by relatively low demand for looser restrictions for European countries and relatively high demand for looser restrictions for non-European countries. Consequently, we include as an explanatory variable the ratio of European admissions to total admissions during each decade in our sample. Note that

non-economic factors such as the degree of ethnic diversity or cultural heterogeneity in the population are likely to influence the relative costs of tightening or loosening restrictions on immigration.

this ratio was highest during the 1950s (52.7%) and since 2000 has averaged 15.6% each year. Data used to compute this admissions ratio come from the *Yearbook of Immigration Statistics*.

Second, we include dummy variables to control for changes in immigration laws during the sample period. These dummies include: (1) the 1954-64 portion of the sample period; (2) the years 1965-79; (3) the years 1980-85; (4) the 1986-89 portion of the sample period; and (5) the period running from 1990 through 1995. Between 1954 and 1964, nationality quotas were in effect. As discussed above, 1965 was the year the Immigration and Nationality Act was amended to introduce two new employment preferences. In 1980 the Refugee Act took effect, which initiated a system for handling refugees as a class separate from other immigrants and established an annual ceiling on the number of refugees admitted. In 1986 the Immigration Reform and Control Act became law, which raised the annual general immigration ceiling from 270,000 to 540,000 and offered amnesty to various classes of illegal aliens. The Immigration Act of 1990 increased the annual immigration ceiling to 700,000 for 1992-94 and to 675,000 for subsequent years. The final dummy is a control for two pieces of congressional legislation in 1996: (i) the Immigration Act, which sought to curb illegal immigration; and (ii) the implementation of the welfare reform bill, which resulted in cuts to social programs for many immigrants.²² We allow the intercept term to capture the effects of the pre-1965 legislation.

²¹ The index for 1954 was not available, so the 1955 index was used.

²² The dummy variable for the 1996 legislation may also capture indirectly the effects on legal immigrant quotas of changes in the volume of illegal migration. Increased illegal migration is likely, all other things equal, to lead to higher demand for tighter restrictions on immigration in general and lower demand for looser restrictions, leading in equilibrium to lower immigrant quotas. Consequently, if legislation requiring greater enforcement of illegal migration results in less illegal migration, the demand for tighter restrictions on legal immigration should fall and immigrant quotas should rise following the legislation.

Table 1 shows selected descriptive statistics for the main variables used in our regression analysis. During the sample period, the annual number of visas issued strictly on the basis of employment preferences averaged approximately 22,400. By contrast, according to the 2002 *Yearbook of Immigration Statistics*, the average number of all immigrant admissions during the period was nearly 575,000. It is for this reason that we were careful not to use total immigrant admissions as our dependent variable, for that number includes mostly persons admitted for non-employment reasons. Note that there has been substantial variation in the supply of employment visas, as the coefficient of variation equals 0.917. Some of this variation is likely to be related to changes in federal immigration quotas over the sample period. Note also that, during the sample period, the economy grew substantially, as did the native and immigrant populations. However, union membership varied less and has been declining steadily since around 1980. Furthermore, the percentage of U.S. immigrants that are non-white has increased over the sample period, while the proportion of immigrants coming from the European countries has fallen significantly.

(Table 1 goes here)

Table 2 presents estimates of two versions of an Ordinary Least Squares multiple regression equation for employment visas issue. Note that across these equations nearly 80 percent of the variation in visa supply is accounted for. No evidence of autocorrelation was found in the equations and both are corrected for heteroskedasticity. For both equations, there is a negative relationship between real GDP and the supply of visas, which is statistically significant at the 5 percent level or better. According to equation I, which omits the U.S. immigration policy controls, a billion dollar increase in

annual real GDP is predicted *ceteris paribus* to reduce the supply of employment visas by approximately 32 per year. When the policy controls are included in equation II, the supply of employment visas drops by approximately 23 per year.

(Table 2 goes here)

In terms of our theoretical model, if an increase in customer demand causes a decrease in the political supply of visas, this implies that in the political market interest groups lobbying for tighter restrictions, particularly native labor in the substitute industry, dominate groups lobbying for looser restrictions, primarily native factor suppliers in the complement industry. Therefore our finding that demand growth has a negative effect on the number of immigrant visas issued suggests that the factor income effects of immigration on the substitute industry are larger than those on the complement industry. The reverse would be true when demand is decreasing, in which case our empirical findings indicate that immigration restrictions would loosen. In this instance, presumably the lobbying efforts of native factor suppliers in the complement industry overwhelm those of native labor in the substitute industry.

We find that the size of the native population, the extent of union membership and the political climate in the U.S. have no statistically significant effects on employment visa supply. However, our proxy for technological progress has a positive and significant coefficient estimate, indicating that visa supply is encouraged, all other things equal, by technological advances. According to equation II, for example, a unit increase in the index of output per hour is predicted, *ceteris paribus*, to result in an increase in employment visas of nearly 3,250 per year. If technological advance is associated with an increasing wage elasticity of labor demand, then we interpret this result as supporting

one of the predictions of our theoretical model, namely, that the greater the wage elasticity of demand for native and immigrant labor in the substitute industry, the looser are immigration restrictions.

Turning to those variables that are associated with conditions facing lobbying groups organized along non-labor market lines, we find that while the national unemployment rate has no statistically significant effect on employment visa supply, the size of the immigrant population does. According to equation I, *ceteris paribus* an increase in the U.S. immigrant community of 100,000 persons is predicted to result in an increase of 340 employment visas issued per year. That estimate rises to 400 per year in equation II. Both coefficient estimates suggest that the immigrant community in the U.S. is capable of exerting a strong influence on the political market for immigration restrictions and that this group's power is likely to continue increasing, given increasing levels of immigration.

Our measure of ethnic diversity has no statistically significant effect on visa supply, but the variable measuring relative demand for visas for persons originating in Europe does have an effect. According to equation II, for example, a one unit decrease in the European proportion of total U.S. admissions is predicted to result in a lower visa supply of nearly 800 per year. The interpretation of this coefficient estimate is that, as European immigration falls relative to other groups, the demand for looser restrictions coming from that group will fall, resulting in a lower equilibrium quota overall. This result suggests that lobbying by groups representing the interests of European immigrants may exert a disproportionately strong effect on the political market for immigration restrictions. Compared to groups lobbying for immigration from other parts of the world,

it appears that European-affiliated groups have more lobbying resources and a louder voice in the political market.

Finally, none of the policy controls included in equation II have a statistically significant effect on visa supply. However, the constant term in that equation is significant, suggesting that the 1996 legislation aimed at deterring illegal migration may have had an effect on the political market for restrictions. According to the regression equation, visa supply *ceteris paribus* after 1996 was slightly lower. However, one would expect visa supply to be larger after 1996 because, assuming the legislation did lead to lower illegal migration, less political pressure would be exerted by advocates of tighter immigration restrictions.

5. Conclusions

We explain the determination of immigration restrictions by combining elements of an interest group analysis of endogenous policy with the neoclassical theory of labor demand. An immigration quota, set by politicians, affects the rates of return to native-supplied factors in the destination economy. An equilibrium quota is determined in a political market in which the income effects of immigration on native-owned factors, as well as the preferences of interest groups favoring or opposing immigration for non-economic reasons, translate into political pressure on politicians.

The equilibrium quota is shown to depend on various parameters of the “substitute” industry, in which native labor and immigrants are substitutes in production, the “complement” industry, in which a native-supplied factor and immigrants are complements in production, and the characteristics of lobbying groups organized along non-labor market lines. Comparative static results demonstrate that the equilibrium quota

is smaller, i.e., more restrictive, the higher is the level of customer demand in the substitute industry, the lower is the level of customer demand in the complement industry, the smaller the size of both industries, the greater the degree of substitutability, or the smaller the degree of complementarity, between native- and immigrant-supplied factors, the greater the share of the immigrant workforce that finds employment in the substitute industry as opposed to the complement industry, the more inelastic the demands for native and immigrant labor in the substitute industry, the greater the share of the destination country's population opposed to immigration on non-economic grounds, the greater the marginal valuation attached by members of anti-immigrant groups to reductions in immigrant admissions, and the smaller the size of the immigrant community. A change in the size of the native labor force will have ambiguous effects on the equilibrium quota, depending on the magnitude of lobbying costs in each industry. If lobbying costs are low in the substitute industry, an increase in the native workforce leads to a smaller quota. In the complement industry, however, low lobbying costs will result in a larger quota when the native workforce increases.

Our empirical results indicate that visa supply appears to be strongly influenced by growth in customer demand, proxied by real GDP. In particular, we find that demand growth *ceteris paribus* results in tighter immigration restrictions. We interpret this result as suggesting that, during periods of growing demand, interest groups that lobby for tighter restrictions, such as native labor in the substitute industry, exert more influence on politicians than interest groups that lobby for looser restrictions, such as native factor suppliers in the complement industry. In terms of our theoretical model, it would appear that, in a growing economy, the effects of immigration on native wages in the substitute

industry more than outweigh the effects on native-supplied factor returns in the complement industry. In contrast, a contraction in economic activity, all other things equal, is predicted to augment the supply of visas, indicating that groups that lobby for looser restrictions dominate the political market when the economy weakens. We also find that technological progress, as measured by labor productivity, brings increases in the immigrant quota. If technological advance is presumed to be correlated with an increase in the wage elasticity of labor demand, then this result supports the prediction of our theoretical model that a growing wage elasticity of demand for labor in the substitute industry generates a loosening of immigration restrictions.

Some non-economic factors also are found to play a role in determining the equilibrium level of immigration restrictions. The larger the size of the immigrant community in the destination country, the looser are immigration controls *ceteris paribus*. This finding suggests that political pressure exerted by former immigrants has a powerful effect in shaping immigration policy. We also find evidence that, among the immigrant community, those of European origin appear to have a disproportionately large impact on immigration policy. The larger the share of Europeans in total U.S. admissions, the larger the equilibrium immigration quota.

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Appendix

In the text we treated the shares of the immigrant workforce employed in the substitute industry and the complement industry, λ and $(1-\lambda)$, as exogenous. Here we derive a general equilibrium expression for λ .

Since immigrant workers are assumed to be identical in each industry and there are no mobility costs for immigrants between industries, there will in general equilibrium be no difference between the wage paid to immigrants in the substitute industry and the wage paid to that group in the complement industry, i.e., $W_{IS} = W_{IO}$. Thus there will be some value of λ that ensures wage equalization.

Equate expressions (10) and (20), the partial equilibrium immigrant wages in the substitute and complement industries, respectively:

$$(32) \quad \frac{P_s \left[\frac{2\alpha_2\alpha_3}{\alpha_5} - \frac{\alpha_3\alpha_5}{2\alpha_4} - \frac{1}{H} (\theta_{NS}\phi\alpha_5 + 2\alpha_2\lambda\theta_1\varepsilon) \right]}{\frac{2\alpha_2}{\alpha_5} - \frac{\alpha_5}{2\alpha_4}} = \frac{\delta AF^{\frac{1-\beta}{\delta}} \theta_{NS}^{\frac{\beta(1-\delta)}{\gamma}} P_o}{(1-\lambda)\theta_1^{1-\delta}},$$

then, solve for λ :

$$(33) \quad \lambda = \frac{[X_1 + (\frac{2\alpha_2\theta_1\varepsilon - \theta_{NS}\phi\alpha_5}{H})] + \sqrt{[X_1 + (\frac{2\alpha_2\theta_1\varepsilon - \theta_{NS}\phi\alpha_5}{H})]^2 - (\frac{8\alpha_2\theta_1\varepsilon}{H})(X_1 - \frac{\theta_{NS}\phi\alpha_5}{H} - \frac{X_2X_3}{P_s\theta_1^{1-\delta}})}}{4\alpha_2\theta_1\varepsilon / H},$$

where:

$$X_1 = \frac{2\alpha_2\alpha_3}{\alpha_5} - \frac{\alpha_3\alpha_5}{2\alpha_4}$$

$$X_2 = \frac{2\alpha_2}{\alpha_5} - \frac{\alpha_5}{2\alpha_4}$$

$$X_3 = \delta AF^{\frac{1-\beta}{\delta}} \theta_{NS}^{\frac{\beta(1-\delta)}{\gamma}} P_o.$$

To obtain a general equilibrium solution for the immigrant quota, θ_1 , we would substitute expression (33) into expression (29) and solve for θ_1 . However, due to computational complexity, a solution for the quota could only be obtained through numerical analysis, which is beyond the scope of the present paper.



Figure 1

Table 1
Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Employment visas issued	22,373	20,514	1,429	82,579
Real GDP (billions)	\$5,276.9	\$2,367.4	\$2,065.2	\$10,083.0
Native population	194,585,606	30,556,562	139,868,715	245,581,952
Union membership	18,411,967	1,903,700	16,107,000	22,025,000
Democratic administration dummy	0.408	0.497	0	1
National civilian unemployment rate	5.82%	1.45%	3.5%	9.7%
Percentage of U.S. immigrants that are non-white	18.79%	14.24%	1.8%	35.83%
Immigrant population	13,723,000	5,024,100	9,619,000	25,831,000
Index of output per man hour (1992=100)	78.25	22.29	43.6	123.8
European immigrant admissions as a percentage of total admissions	23.87%	14.38%	10.38%	52.7%
Sample size	49 (1954-2002)			

Sources: Bureau of Citizenship and Immigration Services, *Yearbook of Immigration Statistics*
 Federal Reserve Bank of St. Louis, FRED database
 U.S. Census Bureau
 Bureau of Labor Statistics, *Handbook of Immigration Statistics*
 U.S. Department of Commerce, *Statistical Abstract of the United States*
Economic Report of the President

Table 2
 OLS Coefficient Estimates of Equilibrium Quota Equation
 (Dependent Variable = Employment Visas Issued)

Explanatory Variable	I	II
Real GDP	-32.04 (-3.28)	-22.80 (-2.09)
Native population	-0.000025 (-0.22)	0.00032 (1.05)
Union membership	-0.00033 (-0.40)	0.00072 (0.83)
Technology index	3841.0 (3.81)	3226.3 (2.78)
National unemployment rate	-576.56 (-0.67)	194.38 (0.20)
Immigrant population	0.0034 (2.76)	0.0040 (2.53)
Non-white U.S. immigrants as a percentage of total U.S. immigrants	66.77 (0.27)	-2589.5 (-1.17)
European admissions as a percentage of total admissions	735.94 (2.29)	790.42 (2.22)
Dummy for Democratic presidential administrations	537.44 (0.16)	571.25 (0.15)
Dummy for 1965 Amendment To Immigration & Nationality Act		-2376.4 (-0.42)
Dummy for 1980 Refugee Act		49972 (1.01)
Dummy for Immigration Reform And Control Act (1986-89)		52522 (1.08)
Dummy for Immigration Act of 1990		34100 (0.74)
Dummy for 1996 Immigration Reform Act and Welfare Reform Bill		26361 (0.52)
Constant Term	-0.0000002 (-4.89)	-0.0000002 (-0.52)
Adjusted R-squared	0.7906	0.7776

* denotes negligible and significant at less than 10%, ¹ t-ratios in parentheses; bold indicates significance at 10% or better