

# The Effect of In-migration on Labor Demand from the Fall of Cow to Today

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## Abstract

In-migration has often been seen as causing a movement down along a constant labor demand curve. But the new residents purchase non-tradeable current goods and services, and shift the demand curve for labor to the right. In this paper, we lean upon historical episodes and expand the discussion of this “induced demand” for current non-tradeables to include local construction activity spurred on by the migrants’ arrival. We predict that in cities with highly elastic building supplies, a wave of in-migration can generate demand for a quantity of local labor that is twice as large as the initial inflow. On frontiers, the effects of in-migration on labor demand were the dominant cause of economic instability. In colonial Massachusetts, the Puritan takeover of England halted in-migration and generated a depression called “the Fall of Cow”, after its effect on cow prices.

## 1 Introduction

Most discussion on the effect of in-migration has seen the effect of in-migration as a simple shift in the supply curve and a movement on a constant demand curve, and so saw an unequivocal prediction of a decline in wages. The “textbook model” is summarized by Borjas (2003), quoting Samuelson (1964): “The textbook

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model of a competitive labor market predicts that an immigrant influx should lower the wage of competing factors.” This model is based on the assumption that in-migration increases the local supply of labor and has no effect on the demand for labor, and therefore causes the labor market to clear at a lower wage level.

One issue with the textbook model, however, is that it implicitly assumes that labor demand is not also affected by immigration. This is unlikely to be true. A cohort of in-migrants will demand housing, services, and other local non-traded goods, just like any other resident. So the local demand for labor should shift rightward alongside supply, at least partially counteracting the downward pressure on wages.

The question we seek to answer in this paper is how the local demand for labor is impacted by in-migration. The first part of the paper examines a number of historical episodes in frontier regions that suggest migration itself had outsized influence on the economic vitality of those regions. We then identify and discuss four channels through which in-migration can generate labor demand: residential construction, non-residential construction, private demand for non-traded goods and services, and public demand for non-traded goods and services. Then, utilizing previous estimates of building supply elasticity (Saiz 2010) in two U.S. metropolitan areas as well as data on the weight of non-tradeables in total local consumption, we predict the size of the increase in labor demand that would be generated by in-migration into these metro areas, arriving at some prospective bounds of the size of that induced demand increase.

The significance of the labor demand effect of in-migration was recognized by Ben-Porath (1986), who wrote “[immigration] generates surges in demand that directly affect the level of activity and may induce further changes in factor supplies”. According to Ben-Porath, immigration creates demand for housing and capital through both consumption and increased labor supply. Results from his examination of output growth and immigration in Mandatory Palestine (1920-1948) indicate that exogenous waves of immigration led to growth and also that immigration responded to per capita income and consumption growth rates.

Cairncross (1953), using pre-World War I data, finds that a rise in the flow of migration from Scotland to western Canada was associated with a rise in economic activity in Canada and a decline in economic activity in Scotland. A fall in the flow of migration from Scotland to Canada was associated with a fall in economic activity in Canada and a rise in economic activity in Scotland. Still, the data that Cairncross collected does not show the direction of causation.

However, the beginning of World War I cut off movement of migrants across the Atlantic. This cut-

off in immigration generated a deep recession in Vancouver, which was the largest recipient of Scottish immigrants. Many causes have been offered for World War I; no one so far as we know has suggested that the war was caused by the prospective recession in western Canada. The months immediately following the period discussed by Cairncross thus provide clear evidence that part of the flow of causation is from a rise in in-migration to a rise in economic activity.

In the 1630s, Puritans migrated from Britain to New England, spurred by fear of religious persecution. This exogenous immigration led to economic growth in the Massachusetts Bay Colony, where a pioneering-and-building industry thrived during years of migration. In the 1640s, the direction of that exogenous migration was reversed by the Puritan takeover of England, and Massachusetts experienced a depression. Likewise, political events in Poland influenced the economy of Tel Aviv in the 1920s. In the early part of this decade, the local economy in Tel Aviv expanded as Polish Jews fled from an anti-Semitic Polish regime and settled in Tel Aviv. A depression followed in 1925, when a coup in Poland that brought to power General Joseph Pilsudski, who was committed to non-discriminatory treatment of all Polish citizens and therefore to fair treatment of Polish Jews, stopped that migratory flow.

These experiences imply that there is a causation running from immigration to increased economic activity. In the above cases, an exogenous cause for immigration into a region can be identified, and these stories can be viewed as natural experiments for the hypothesis that there is causation flowing from in-migration to economic growth. Episodes of concurrent economic booms and in-migration, such as that of Seattle during the 1880s and Nevada before 2008, are not such natural experiments, as there is no clear exogenous cause for in-migration. The data from such periods are consistent with either or both causation flowing from in-migration to economic growth and that flowing from economic growth to in-migration. In the next section we discuss some of these historical examples in more detail.

## **2 Instability in Frontiers**

### **2.1 The Fall of Cow**

The Fall of Cow in colonial Massachusetts was the first depression in U.S. history. From 1630 to 1640, a net of about 1,000 adults per year immigrated to New England. An important motivation for this migration

was fear of religious persecution in England and hopes for the construction of a Puritan Utopia. The white population of New England before this migration was about 1,000 adults. During the 1630s, the bulk of the economic effort of the community was directed to clearing land, building houses and breeding livestock. All three activities generated goods which were, in the normal course of events, non-tradeable. No appreciable effort was directed at producing tradeable goods.

Wages in New England were dramatically higher than in England during the 1630s. The response of the General Court of Massachusetts (the colonial legislature) was an attempt to fix legal maximums for wages. The main effect of these maximums was to propel a few young men into self-employment a little sooner. The migration consisted not only of Puritans longing to aid in founding a “city on a hill”, but of young men and women of no strong religious attachment (including a few Irish Catholics) who migrated seeking economic gains, often trading five years of labor as indentured servants for passage.

The English were used to consuming milk, and pasture was abundant. Passage across the Atlantic for a cow cost £15; passage for a human adult, £5. Cows sold in the 1630s in New England for over £20. So buying a cow in New England was likely to cost a man as much as the cost of passage for his family. Breeding cows to sell to newer settlers was an important source of income for those already settled (Cressy 1987, p. 118).

At the beginning of the 1630s, settlers lived in dugouts and ate the food they had hauled over with them. Each family had to take with them 18 months’ food and spirits. Anyone bringing less was unwelcome (Cressy, p. 110). So with food coming out of baggage, the new settlers’ concentration on clearing land, building huts and breeding cows was very nearly complete. The settlers who came in the late 1630s often found it worthwhile to skip the rude pioneer stage and purchase huts and cows and cleared fields from veteran settlers.<sup>1</sup> Those who had learned to clear land and build huts stayed specialized in pioneering, building a farm for sale then moving further off into the wilderness to clear and build another.

During this period the exports of Massachusetts were limited to furs and a few long logs to be made into masts.<sup>2</sup> Massachusetts produced non-tradeables and sold property to immigrants who brought cash or goods, and borrowed to pay for tradeables. Everything that could be imported was imported - even fish.

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<sup>1</sup>Francis Kirby wrote in 1637 from New England to a nephew about to depart to use “the lesser half. I suppose he hath in money, and vendible goods to provide him a cottage to dwell in, and a milshe cow for his childrens sustenance” (quoted in Bailyn (1955), p. 47).

<sup>2</sup>The quantities of everything else came closer to samples than normal commerce.

This specialized commerce was interrupted in 1639 when it looked likely that the Puritans would win out in England.<sup>3</sup> In the depression which followed, the colonial legislature Great Court sought to shield debtors from creditors. Just as earlier, they had proclaimed just wages lower than market wages, and now they proclaimed “just prices” higher than market prices. They decreed in 1641 that farms and buildings were worth just as much as ever, as their real usefulness had not diminished and so they would be valued (on being turned over to creditors) not at the then-current market prices but at the prices before the Fall of Cow.

The economic repercussions of the news were understood very well and very quickly in Massachusetts. As soon as the first news came of the possibility of a Puritan victory in the spring of 1639, the price of a cow fell in New England from £22 to £5. This was the “Fall of Cow”. At the same time, the money price of farms fell by two-thirds and the price of wheat fell in half (Gottfried 1936, pp. 660-662).

Some hoped vainly for good news but the Puritans took over England and immigration stopped. No Puritan would need to migrate to New England, and few Roundheads (Anti-Puritan) would be likely to choose the fire of New England over the frying pan of old England. No new cows needed. The officials of the colonial government immediately started searching for “returns” (something to sell in England). The current account would have to balance or over-balance. Industrial policy was popular in Massachusetts even then, and the governor and his men searched for winners. The fur business was pressed; fishing villages were established on the coast, even if the boats had to be crewed with foul-mouthed sailors; spinning and weaving became patriotic activities; and an iron industry was started. The iron works was the largest and most prestigious. The governor’s son led the effort and the public treasury contributed. The operation was never profitable; literal returns in fact were never found. New England stayed in bilateral deficit with old England for the next 150 years.

Export markets were found in the wine islands of the Atlantic and in the sugar islands of the West Indies, which bought the wood, cows (in the form of salt beef) and horses which could no longer be sold to new immigrants, and much of the fish caught in the new fishing villages. The commerce moved largely in vessels built in and crewed from New England.

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<sup>3</sup>Winthrop, the first Governor of Massachusetts, wrote in his diary, “A general reformation of church and state... caused all men [Puritans] to stay in England in expectation of a new world” (quoted in Bailyn (1955), p.46).

## 2.2 Mandatory Palestine

A good parallel to the experience of the Commonwealth of Massachusetts in the 1630s and 1640s was the economic experience of the Jewish community of Mandatory Palestine from 1918 to 1939. This community, which conducted its economic life largely separated from its Arab neighbors, grew mostly by immigration and very unsteadily from 56,000 in 1918 to 600,000 in 1947, a rise of 8.9% per year. From 1922 to 1947, per capita real product grew at 4% per year (Szereszewski 1968).

This immigration was propelled by persecution in Europe and by the movement of people from both Europe and Muslim countries hoping to build a third Jewish Commonwealth. In the disorganization and confusion of central and eastern Europe immediately after World War I, and with the stimulus of the announced policy of the British to help build a Jewish homeland in Palestine, the Jewish population of Palestine tripled from 1918 to 1926. But in 1927 and 1928 when most of eastern and central Europe appeared stable, there was net Jewish emigration from Palestine. This was particularly influenced by the successful 1926 coup of Joseph Pilsudski in Poland, who championed non-discriminatory treatment of Polish Jews. After 1928, Jewish immigration increased again as anti-Jewish political forces gathered steam from Germany to Romania. In 1934 the Jewish population of Palestine grew 27%.

Real output varied with immigration. In 1926 there was a depression in Palestine which parallels the Fall of Cow. Building stopped and unemployment soared. The impact of the stop in building was drastic. In Tel Aviv in 1925, 45% of the working population was in building (Sacher 1982, p.153). In 1925 expenditures on structures equaled 34% of the GNP of Jewish Palestine. By 1927, construction expenditures had declined 80% in real terms. Another parallel to New England: it was only *after* the boom had bust that investment in citrus groves bloomed. Such investment rose by a factor of 10 from 1925 to 1927 (Szereszewski 1968).

While Hitler and his Eastern European imitators gathered strength from 1929 to 1933, output in Jewish Palestine grew at 19% per year and per capita output rose at 11% per year; not much of a Great Contraction. In fact, until 1936 “the land” (as Jews called it) boomed, *per capita* real income rose at 8% per year as the population rose at 13% per year. In 1936 the British imposed new tighter limits on Jewish immigration to Palestine and real per capita income actually fell from 1936 to 1939.

Ben-Porath (1986, pp. 37-40) reports the results of Granger-Sims causality tests which ask if immigration

led per capita real GNP or real GNP led immigration. There was a tight relationship from 1926 to 1948 between per capita real income and lagged immigration ( $F=6.5$ ). Ben-Porath finds no significant relationship in that period between lagged per capita real income growth and current immigration. Immigration caused growth; growth did not cause immigration. Real output movements in Palestine had little effect on either Hitler's persecution or on the British government's willingness to let immigrants enter Palestine. Jewish immigration to Palestine was mostly caused by factors that were exogenous to the Palestinian economy.

In Palestine, immigration generated capital inflow. On the other hand, New Zealand in the 1870s did the reverse. Capital inflow was the exogenous variable. Prime Minister Vogel arranged to borrow £20 million. His budgets were thirteen times the size of Canada's on a per-capita basis. This fortune was spent on railroads, telegraph lines and bridges, and subsidized passages for immigrants. The economy "thrived as never before" and the subsidies attracted enough immigrants so that the population of New Zealand from 1870 to 1890 grew more rapidly than it ever would again. In 1880, after the borrowing slowed down, unemployed workers unsuccessfully petitioned the President of the United States for assistance to migrate (Sinclair 1959, p.159).

### **2.3 The In-Migration Multiplier-Accelerator, and Export Rescue**

The experiences in colonial Massachusetts and in Mandatory Palestine can be generally described in the following sense. A wave of in-migration lowers the capital-labor ratio of a region below equilibrium. Most capital will be built locally, as real estate improvements are not tradeable. In this period both the rental costs of capital and wages are much higher than in settled countries. Exports cost too much to make, people are making non-tradeable capital and consumption goods and services, and the region specializes in growth.

Applying the concept of a multiplier/accelerator, as in the Samuelson (1939) model of national income, to migration shows the possibility that growth in the frontier can be explosive. In a pioneer society, the in-migration of one worker causes a demand for four or five years of labor to produce all the non-tradeable capital to complement that worker in equilibrium. (The historical capital-income ratio in the U.S. has stayed between 400 and 500 percent.) This is analogous to the explosive case in the Samuelson model where the private investment response to increase in consumption is high enough to cause divergence in national

income.

More specifically, the Samuelson model of year- $t$  income  $Y_t$  given a pulse of 1 unit of spending each year is given by  $Y_t = 1 + \alpha[1 + \beta]Y_{t-1} - \alpha\beta Y_{t-2}$ , where  $\alpha$  is the propensity to consume and  $\beta$  is the proportion of induced investment to a consumption increase. Frontier migration represents a case where  $\beta$  is between 4 and 5, which is large enough to cause  $Y$  to grow without limit.

If there is a sudden interruption in in-migration, a bust follows as there is now an excess supply of capital; the busts are deep depressions. Belich (2009) shows that historically almost all of these migration-interruption busts have been followed by an “export rescue” as wages and capital rentals fall relative to those in settled areas, which allows the export rescue. In many cases the exports are staple goods, but as we have discussed, in the Massachusetts Bay Colony the key item in the export rescue was shipping services. The principal physical exports, ships and rum, were both manufactured goods. In Palestine the export rescue from the depression induced by the British near-ban on in-migration was in services and manufactured goods provided to the British war effort in the Middle East in World War I.

### 3 The Effect of In-Migration on Labor Demand Today

We now turn from the tales of frontier migration to a more general discussion of migration-induced demand today.

One cause of the increased economic activity is the production and consumption of non-traded goods and services: newly arrived migrants eat at restaurants, get haircuts, go shopping, and educate their children, and the local demand for labor will rise as a result. Neary (1989) suggests that (permanent) immigration can push up the price of non-traded goods in the recipient country by inducing demand, if the increase in demand is strong enough to overwhelm the supply increase. Baghdadi and Jansen (2010) find that both permanent and temporary immigration lowers prices of non-traded services on the whole, but that permanent immigration raises prices of transport and health services while temporary immigration raises prices of utilities and transport services. Hong and McLaren (2015) argue that migration increases both the amount and diversity of local non-tradables demanded, and find empirically that immigration into a U.S. metropolitan area on average creates more local jobs than the initial size of the migration wave.

Of course, migrants also need somewhere to live, learn and shop. The immediate effect of a wave of in-migration and ensuing upward pressure on demand for the services of the built environment is an increase in crowding and rents, as new dwellings, schools and shops take time to build. New housing available in the short run will be expensive; in the moderate run, when the quantity of housing is able to respond, it is reasonable to assume that their demand for housing will be met by construction of new residential units.<sup>4</sup> If the migrants are poorer than the settled population, the occupants of the new housing will be almost exclusively those from the settled population. We are primarily concerned about this moderate-run effect.

The local economy then begins to focus on construction of housing. As a result, the demand for construction labor in this region rises. (Note that housing is non-traded, so it is local demand that rises.) To support the higher population, infrastructure and services, both of which must also be supplied locally, will be in higher demand as well. Thus demand for these types of labor also rise. Much of this increase is temporary, lasting only as long as the houses are being built and infrastructure placed. But in the moderate run, the demand schedule for labor can rise sharply as a result of migration, so the decrease in wages caused by in-migration is lower than it would be otherwise. If this demand increase is greater than the increase in labor supply, further in-migration would be induced to meet the excess demand.<sup>5</sup> This mechanism is partly explored in a recent work by Howard (2017), who also identifies house price increases induced by migration as a further driver of labor demand. Still, construction is a channel that has not been emphasized in the literature on local demand effects. This paper is an effort to provide a combined treatment of the non-tradables and construction responses to migration.

Taking this mechanism into account can cast some important pieces in migration literature in a new light. Card (1990), in the famous study of the Mariel Boatlift's effect on the Miami labor market, finds that the exogenous 7% increase in local labor supply did not significantly push down low-skilled wages as such excess supply would be expected to. He cites Miami's relative specialization in industries that require low-skilled labor, its high Hispanic concentration, and the response of domestic migration into Miami (fewer

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<sup>4</sup>There are certain parameters that may affect the magnitude of construction. For example, if migrants are willing to pack together into temporary or high-density housing – such as the dormitory-style “man camps” occupied by workers involved the recent North Dakota oil boom – there will be less of an increase in the demand for housing and there won't be as much new housing built. But this factor will influence only the magnitude and not the direction of housing supply change.

<sup>5</sup>An interesting special case is that of retirees. A population influx made up primarily of retirees (experienced by certain sunny regions, for example) will raise local labor demand but will not raise supply. Thus the local real wage should unambiguously increase.

people moving there after the Boatlift than would have if the event hadn't occurred) as explanatory factors for this phenomenon.

We have an additional explanation: not only did the supply of labor increase in Miami, but the demand for labor (in construction, services, and more) also rose. Perhaps new housing was not very sharply demanded in Miami – Saiz (2003) finds that most of the quantitative adjustment to increased housing demand immediately after the Boatlift was done through increased residential density, not construction – but houses take time to build, and almost none of an unexpected inflow of migrants can be accommodated in the short run by increased permanent homes. In the immediate aftermath of the San Francisco earthquake of 1906, a general shortage of housing was prevented in the short run by a rise in rents, which induced many to double up and some to live in tents. Only in the moderate run did the permanent housing supply respond (Friedman and Stigler 1946).

Throughout this paper, we consider migration of labor without regard to the nationality of the migrants. That is, we make no distinction between international immigrants and migrants who simply move within a country. In addition to simplifying the discussion, this reflects the idea that characteristics like skill and income are most likely to be the ones that make a first-order difference in a migrant's demand for local labor.

We first separate the induction of additional labor demand into two broad channels: demand for real estate improvements, and demand for non-housing non-traded goods and services. While the demand for local construction could be thought of as a component of the demand for local non-tradables, we make the distinction because it is not a permanent effect in the sense that demand for other non-traded goods is.

### **3.1 Effect on Construction**

After a wave of in-migration, the new migrants will initially generate demand for non-traded goods and services and will continue to do so for as long as they live there. On the other hand, construction is not labor-intensive to maintain once it is built; the initial surge in the demand for labor while new dwellings are being constructed will dissipate once housing supply rises, and the price of housing will eventually come back down. Thus it makes sense to separate out these effects and consider two estimates: one on the impact effect of migration (working over the moderate run) and another on the effects present in the long run, after housing has adjusted.

Three particular characteristics of the local economy may affect the magnitude and form of the labor demand increase from construction. First is the relative proportion of inputs to building that are supplied locally. Such inputs may include building materials such as lumber and glass, products such as windows, and labor (in both construction itself as well as in the production of intermediate goods). Naturally, the more intermediate goods to housing that a region specializes in producing, the more that region's labor demand will be stimulated if given an increase in building activity. If the input in question happens to be tradable, then the local supply is important only if the area is an important producer of that input. In the 1880s, the Washington Territory was an important supplier of timber to the west coast of the U.S. Thus the rapid growth of the Territory's population should have led to a higher increase in labor demand than if the growth had occurred in an area like southern California, which was not an important producer of timber.

The second characteristic is the local building supply elasticity. Supply elasticity is affected by several factors, including land availability, and regulatory hurdles. These factors determine how much the cost of reproducing houses rises with an increase in housing production. Scarcity of land, expensive building supplies, and strict regulation all drive up the cost of construction. In particular, binding regulation that restricts construction – such as zoning laws and height limits – makes it more difficult for supply to adjust to demand, and lowers the elasticity of the supply of buildings there.

Glaeser, Gyourko, and Saks (2006) show that cities with highly elastic housing supply (limited regulation and low density) respond to increased demand in the industry they specialize in with a relatively large increase in population (and therefore larger quantities of new homes), while cities with inelastic supply respond with a smaller increase in population but a larger increase in housing prices and income. Saiz (2010) identifies topographic factors that render regions undevelopable, such as steep slopes and bodies of water, as a cause for housing supply inelasticity; using GIS tools, he measures the proportion of the area around each metropolitan area that is rendered undevelopable, and combines these measures with indices of regulatory restrictions on building to produce estimates of local building supply elasticity. He also finds that topographic factors actually affect the severity of building regulations. We note that housing supply elasticity in this case can be treated as a proxy for the supply elasticity of all buildings. There is significant positive correlation between private residential construction and private nonresidential construction.

The third characteristic is the proportion of local real estate that is owned remotely. Who owns the

housing is relevant because when housing rents go up, say as a result of in-migration, a renter's cost of living rises, which reduces his real income. The renter's extra expense is transferred to the landlord, whose income goes up. Whether aggregate local income rises as a result of this in-migration then depends in part on whether the landlords live in this area or own the buildings here and are settled elsewhere. If the owner lives locally the net income effect is zero.

### 3.2 Effect on Non-Traded Goods and Services

We now turn to a discussion of demand for current, as opposed to capital, non-traded goods and services. As modeled by Hong and McLaren (2015), we may consider at least two ways that migrants could increase the demand for labor through non-tradables: by increasing the quantity of existing non-tradables that is demanded (and thereby inducing producers to expand labor inputs), and by expanding the menu of non-tradables that are offered with new types of goods and services.

Several factors influence the magnitude of this increase in demand. One is the share of local expenditures on non-tradables: the higher this share, the more income that accrues to local workers. (In the Hong and McLaren model, if this weight is sufficiently large, real wages in a migration-receiving region could increase following the inflow.) Another is the degree of capital mobility: if capital is unable to adjust sufficiently in the migration-receiving area, then the local marginal product of labor falls after the increase in labor supply, and wages suffer. Higher capital mobility will alleviate this, and under perfect mobility there is no change in the marginal product of labor.

The textbook definition of a non-traded good is one that cannot be transported and sold somewhere other than where it was produced, due to factors such as cost of transportation and durability. But in reality, distinguishing between traded and non-traded goods is not always easy when trying to account for whether the consumer's expenditure on that good ends up staying local or goes elsewhere. Tradability is a "simplifying concept which assumes all goods can be classified into those that could enter into foreign trade and those that do not because transportation is not feasible for them", and "this overly sharp distinction between classes of tradable and non-tradable goods is an analytically simple way of taking transportation costs into account" (McKinnon, 1963). Harrod (1939) explains that "retails goods must in general be regarded as amalgams of [traded and non-traded] goods", because the final retail price of a good must reflect transport and other

intermediate costs.<sup>6</sup>

A meal at a restaurant is generally considered a non-traded good since it is sold where it's prepared, but the cost of that meal has a traded and non-traded component – the materials used to prepare the meal are the largest traded component and the labor involved in preparing and serving the food is the largest non-traded component. The former will raise income over a wide area and not be particularly concentrated to where the meal is bought. Likewise, a traded good sold at retail (such as clothing) will usually have a substantial non-traded component, most of which is local labor.

For another example, housing is treated as almost perfectly non-tradable, and indeed the physical dwelling is not transportable – but titles and IOUs are readily tradable. The fact that IOUs and titles are tradable raises the elasticity of the supply of housing in any local area, as there is less need for local saving to rise in response to the rise in local investment. The net sales of titles and IOUs from the area of in-migration give the area a surplus on capital account, which will raise the real exchange rate of the area. This rise in the real exchange rate will raise net imports of goods and services. An area of heavy in-migration suffers a version of the “Dutch disease”, with the place of increased production of natural gas in Holland substituted by the increased export of titles and IOUs from areas of settlement.

The net export of titles gives rise to the aforementioned complication that a lower ratio of local ownership to external ownership of real estate will lower the impact on the local economy after a burst of in-migration, as the rise in rents will raise net rent payments to external owners of real estate. Additionally, because pre-assembled and mobile housing are in fact traded goods (though they may not be perfect substitutes for traditional housing), there will be some part of total local housing expenditures that flow elsewhere.

In order to estimate the rise in the demand for local labor, it is still important to distinguish and estimate expenditures on traded and non-traded components of goods and services, because we are interested in the effect of in-migration on the local economy. The feedback loop between migration and economic activity in the same region works mostly through the local demand for non-tradables – dwellings, education, health care, and more. The magnitude of induced activity and induced migration will depend on the propensity to demand non-traded goods.

Given the consideration that almost all products have traded and non-traded components, a simple cate-

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<sup>6</sup>In the context of international trade, a once-tradable good that has made it to a domestic shop window can only be sold domestically (in other words, is no longer tradable) because it can no longer be exported at the now-higher price.

gorization of goods as fully one or the other, as is common in immigration and international macroeconomics literatures (Baghdadi and Jansen, 2010; Cortes, 2006; Crucini and Shintani, 2008), is likely to be unsatisfactory for our purposes. Our approach is to assume that a certain proportion of expenditures on each goods category is the non-traded component – say, two-thirds for food away from home and one-half for alcoholic beverages.

## 4 Two Numerical Estimates of the Effect of In-Migration on the Demand for Labor

Given the lack of access to precise data at the MSA level, our purpose is to show that migration has a significant effect on labor demand; we do not aim to precisely quantify that effect. Furthermore, directly estimating the effect of migration flows on construction is difficult due to the imprecise nature of high-frequency population and net migration estimates at the U.S. metropolitan area level (evidenced in part by the large corrections on annual population estimates that are performed by the Census Bureau after each decennial census). Instead, we examine the ratio of value of built environment to income across cities.

We would like to estimate, in essence, how much labor demand is generated by one resident migrating into a region. For the practical purpose of producing estimates, it is sensible to quantify all units as dollar values. This allows us to abstract away from the heterogeneity of migrants and construction, which would be more difficult if we think in terms of numbers of individual migrants and numbers of housing units.

Regional differences in the induced demand for labor seem to be largely determined by differences in the supply response of housing to rising prices. There is little variation across MSAs in the propensity to demand non-traded goods when housing is removed, as seen in Table 2. Thus we use the simplifying assumption that the proportion of expenditures on non-traded goods excluding housing is equal everywhere.

The predictions that we generate are answers to the following question: given an exogenous increase in in-migration into some county equal to 1% of population, how large is the induced increase in demand for local labor?

Given our discussion thus far, and with several simplifying assumptions, we can begin to write down the key components of this demand response. The predicting equation is given by

$$Response_i = \left( \frac{TotalBE_i}{100} \cdot \frac{elas_i}{1 + elas_i} \cdot s_{cLL} \right) \cdot \frac{1}{Income_i} + \left( \frac{Pop_i}{100} \cdot s_{NT} \cdot s_{NTLL} \right) \quad (1)$$

Where  $Response_i$  is the predicted labor demand induced by in-migration (in terms of local wage-years) in county  $i$ ,  $TotalBE_i$  is the county's total value of built environment (in dollars),  $elas_i$  is its price elasticity of building supply,  $Income_i$  is its per capita annual income,  $Pop_i$  is its population, and the  $s$  terms represent various share values –  $s_{cLL}$  is the share of construction expenditures accruing to local labor,  $s_{NT}$  is the share of aggregate expenditure on non-housing non-tradables, and  $s_{NTLL}$  is the share of expenditure on non-tradables accruing to local labor.

The first additive term captures the construction channel. Assuming the demographic composition of the in-migrants is similar to that of the natives (specifically, that the newcomers have the same income distribution as the natives), a 1% increase in population due to migration should result in a 1% increase in the demand for built environment, in dollar terms. Of this increased demand,  $\frac{1}{1+elas}$  will be met by an increase in prices and  $\frac{elas}{1+elas}$  by increased construction activity. Then  $\left( \frac{TotalBE_i}{100} \cdot \frac{elas_i}{1+elas_i} \cdot s_{cLL} \right)$  is the value of construction activity induced by in-migration that accrues to local labor, in dollars. Dividing this quantity by per capita annual income simply changes the units to wage-years.

The second term captures the current non-tradables channel. Again, a 1% increase in population is assumed to cause a 1% increase in non-tradables expenditure, and here we express this quantity as wage-years equal to 1% of the existing population, multiplied by the share of expenditure on non-tradables. Further multiplying by the share of that expenditure accruing to local labor, we have  $\left( \frac{Pop_i}{100} \cdot s_{NT} \cdot s_{NTLL} \right)$ , the value of non-tradables production activity induced by in-migration that accrues to local labor.

In practice, the share  $s_{NT}$  is computed as the sum of shares of private and public expenditure on non-tradables. The former is calculated from MSA-level categorized consumption tabulations in the Consumer Expenditure Survey; as the MSA-level shares are relatively similar for all regions (ranging from 0.332 to 0.398), we assume a uniform value of 0.375 across all MSAs. The latter is calculated at the aggregate level using state and local government expenditure data from the St. Louis Fed's FRED time series and the Census Bureau. (For details of these calculations, see the Appendix.) We then obtain a value of 0.47 for  $s_{NT}$ .

At this point we make assumptions for the values of  $s_{C_{LL}}$  and  $s_{NT_{LL}}$ : two-thirds and three-fourths, respectively. Conceptually, the share of local labor in construction expenditure includes on-site construction labor, as well as workers producing intermediate goods to construction and the labor of developers, architects, lawyers, real estate agents, and other off-site professionals involved in construction. The share of local labor in non-tradables is assumed to be higher than in constructions because it includes (among other things) labor-intensive state and local public expenditures such as education.

Consider, as an illustrative example, the case of Harris County, Texas, which is part of the Houston metropolitan statistical area. Suppose that there is an exogenous 2.7% pulse in in-migration into Harris County; this is the relative magnitude of the permanently-settled migration inflow experienced by Houston following Hurricane Katrina. Today this inflow would number roughly 120,000 migrants. Of these, about half or 60,000 would be in the labor force (assuming the labor force participation in this overall population reflects the U.S. average). Given the Houston MSA's building supply elasticity of 2.3, and substituting Harris County's 2015 appraisal values and per capita income, Equation (1) becomes

$$\begin{aligned}
 \text{Response}_{\text{Harris}} = & \\
 & \left( \frac{384362133000}{100} \cdot 2.7 \cdot \frac{2.3}{1 + 2.3} \cdot 0.66 \right) \cdot \frac{1}{29047} \\
 & + \left( \frac{4441370}{100} \cdot 2.7 \cdot 0.47 \cdot 0.75 \right) \\
 & \approx 164346 + 42271 = 206,617
 \end{aligned}$$

That is to say, an influx of 120,000 in-migrants into Harris County may generate demand for as many as to 206,617 wage-years of labor over the following years. Construction accounts for 164,346 wage-years. The induced labor demand is over 135% of the initial in-migration in this case.

As new demand outstrips new supply, real wage should not change in Harris County and Houston. There will be comparatively more construction activity in Houston than elsewhere, and there will be capital inflows to finance the surplus construction, leading to a current account deficit.

The above narrative assumes that there is a steady existing flow of in-migration, which means that construction lags have no effect on the response of construction. On the other hand, if the in-migration is one-time, then the resultant construction will be spread out over the next few years; that is also to say that

if construction is not lagged and is simultaneous with the in-migration, the construction effect will look the same as that under steady flow.

We can do a similar analysis for the Mariel Boatlift, if it were to happen today; that is, if Miami's building supply elasticity and the propensity to spend on non-tradables were the same as what they are today. The Boatlift resulted in a 7% increase in Miami's local labor force, according to Card (1990); the new immigrants also tended to have smaller earning power relative to the existing population, meaning they both supplied and demanded smaller quantities of labor in dollar terms. They could also be expected to have little access to credit and transfer fewer resources than domestic immigrants might. If we assume that each immigrant supplied and demanded one-half the quantity of labor as an existing resident<sup>7</sup>, the Boatlift would have produced an influx of income equal to 3.5% of Miami's aggregate wage income (equal to about 91,500 residents' annual income).

There are some additional considerations that could further refine these estimates. One is the accuracy of the measured total market value of building improvements in a metropolitan area, which is needed to compute the increase in local construction demand. Nominally this can be found by subtracting the total assessed value of land from the total value of all real property. However, the value of land itself contains some components we consider to be improvements: the additional value of the permit to build on a lot, for example, which can be expensive and is certainly a procedure for adding value to the lot, is treated as part of the value of land. For example, in King County, WA, an empty lot in an already developed neighborhood has its entire value considered as land – no proportion of the value is considered improvements. Physical infrastructural improvements of lots performed to make development possible, such as streets and public sewage, have the same issue.

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<sup>7</sup>The exact proportion of the immigrants' earning capacity relative to the incumbents' will not change the overall direction of impact of the in-migration, since the ratio is applied to both labor supply and labor demand of the immigrants. It will impact the size of the impact on the labor market, however.

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Table A.1: Classification of Consumer Spending Categories

Fully traded	Fully non-traded	Contains both components (proportion non-traded)
<ul style="list-style-type: none"> <li>• Housekeeping supplies</li> <li>• Household furnishings and equipment</li> <li>• Apparel and services</li> <li>• Vehicle purchases (net outlay)</li> <li>• Gasoline and motor oil</li> <li>• Reading</li> <li>• Tobacco products and smoking supplies</li> </ul>	<ul style="list-style-type: none"> <li>• Shelter</li> <li>• Utilities, fuels, and public services</li> <li>• Household operations</li> <li>• Other vehicle expenses</li> <li>• Public and other transportation</li> </ul>	<ul style="list-style-type: none"> <li>• Food at home (1/3)</li> <li>• Food away from home (2/3)</li> <li>• Alcoholic beverages (1/2)</li> <li>• Health care (2/3)</li> <li>• Entertainment (2/3)</li> <li>• Education (2/3)</li> </ul>

(“Personal care products and services”, “Miscellaneous”, “Cash contributions”, “Life and other personal insurance”, and “Pensions and Social Security” are omitted from total expenditure entirely, due to ambiguities in the categorization.)

## Appendix: Calculation of the weight of non-tradables in expenditure

The Bureau of Labor Statistics publishes reports on MSA-level average consumer spending across 28 sub-categories, using data from the Consumer Expenditure Survey. We classified each category as traded or non-traded expenditures, with some being considered both and its value split between the two classifications. Housing is omitted entirely, since we have already accounted for it as a separate category from current nontradables.

We then find the ratio of non-traded to total expenditures for each MSA, reported in the next table. Most of the variation across MSAs is in housing; once that is taken out, the ratios are very similar across all regions, ranging from 0.332 to 0.398 in our sample and averaging 0.375.

To this we add public expenditures on non-traded goods and services. The St. Louis Fed’s Federal Reserve Economic Data (FRED) publishes time-series data on state and local government expenditures, and the U.S. Census Bureau publishes categorized state and local government expenditures. We find that aggregate state and local expenditures (not including transfers) is about 28% of total private consumption,

Table A.2: Share of Non-tradables in Expenditure, CEX Summary MSAs

MSA	Share of non-tradables in total expenditure, minus housing expenditure
Atlanta	0.373
Baltimore	0.371
Boston	0.384
Chicago	0.379
Cleveland	0.389
Dallas-Fort Worth	0.381
Detroit	0.398
Houston	0.399
Los Angeles	0.354
Miami	0.363
Minneapolis-St.Paul	0.385
New York	0.371
Phoenix	0.375
Philadelphia	0.379
San Diego	0.332
San Francisco	0.363
Seattle	0.374
Washington, D.C.	0.377

Source: 2010-11 Consumer Expenditure Survey tabulations.

and that about 65% of those expenditures are on goods, services, and capital (as opposed to interest, public welfare, and other such expenses). Thus with the public expenditure added (and averaging across MSAs, as the numbers are again very similar), the production of non-housing non-traded goods is a quantity equal to 47% of total income. This generates the  $s_{NT}$  value of 0.47 that we use in subsequent steps.