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The Employment and Wage Effects of Immigration: Trade and Labour Economics Perspectives

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Abstract

This paper presents a detailed survey of results from current research on the labour market effects of immigration. It argues: 1) that econometric research uniformly finds very small labour market effects of immigration; 2) that labour and trade economists have differed in their interpretation of this finding; and 3) that this difference is driven exclusively by different dimensionality assumptions (with labour economists preferring a 1-sector x m-factor model and trade economists an n-sector x m-factor model). It is then argued that the trade economists' model; along with its presumption of factor-price insensitivity is the more useful as a presumption generator.

Outline

1. Introduction
2. How Labour Economists Have Evaluated the Effects of Immigration
3. Trade Theory as A Guide to Interpreting Empirical Results
4. Conclusions

Non-Technical Summary

We may not be living in *the* age of mass migration, but we are surely living in *an* age of mass migration. From 1965 through 1990 a fairly constant 2.2% of the world population have been migrants. However, this has involved an increasing rate of change to keep pace with the growing world population: the stock of migrants grew at 1.2% from 1965-1975; 2.2% from 1975-1985; and 2.6% from 1985-1990. More importantly, for the purposes of this paper, relative to regional population, the share of migrants in the US and Canada rose from 6% in 1965 to 8.6% in 1990 (with the greatest growth in the 1980s and 1990s); while the share in Western Europe rose 3.6% to 6.1% over the same period. This period has also seen a substantial shift toward developing countries as source countries for this migration: in the United States this share rose from 42% in 1960-1964 to over 80% in the 1980s and 1990s; in Canada this share rose from 12% to over 70%; while this share in Australia rose from 7% to over 70%. In the 1990s, Germany and Austria experienced very large flows from Eastern Europe as well. Overall, then, there has been a substantial rise in unskilled immigration into industrial countries.

As is well known, this period of rising immigration of unskilled workers coincides with a period of strong deterioration of the relative (and possibly the real) return to native unskilled labour in nearly all industrial countries. While much of the research on the causes of this phenomenon has focussed on demand-side factors, with special emphasis on international trade and skill-biased technical change, unskilled immigration has received a considerable amount of attention as a possibly relevant supply shock. However, unlike the case of the relationship between international trade and labour market outcomes, where there is considerable disagreement on the facts, the overwhelming majority of empirical studies agree that there is essentially no statistically significant effect of immigration on labour market outcomes, with the possible exception of the least skilled domestic workers (i.e. that small share of the work force that are high school dropouts).

The apparent occurrence of a large-ish supply shock with minimal economic effect has produced a sizable literature, primarily among labour economists, attempting to either account for the measured smallness or to generate larger numbers. While there is fairly widespread agreement on the smallness of measurable effects of immigration, the interpretation of this fact is a matter of some considerable dispute. We first consider accounts that attempt to retain the main structure of the labour theoretic framework involving primarily issues of internal

migratory response to international migration or the labour market microstructure issues like the possible presence of segmented labour markets. Where the inability to consistently identify significant effects from immigration was seen by some labour economists as something of a crisis, trade economists have been quick to suggest that this finding is, at least prima facie, consistent with standard trade theoretic models. We conclude the paper with a brief discussion of the theoretical basis for this claim.

I. Introduction

We may not be living in *the* age of mass migration, but we are surely living in *an* age of mass migration.[1] From 1965 through 1990 a fairly constant 2.2% of the world population have been migrants.[2] However, this has involved an increasing rate of change to keep pace with the growing world population: the stock of migrants grew at 1.2% from 1965-1975; 2.2% from 1975-1985; and 2.6% from 1985-1990. More importantly, for the purposes of this paper, relative to regional population, the share of migrants in the US and Canada rose from 6% in 1965 to 8.6% in 1990 (with the greatest growth in the 1980s and 1990s); while the share in Western Europe rose 3.6% to 6.1% over the same period. This period has also seen a substantial shift toward developing countries as source countries for this migration: in the United States this share rose from 42% in 1960-1964 to over 80% in the 1980s and 1990s; in Canada this share rose from 12% to over 70%; while this share in Australia rose from 7% to over 70%. In the 1990s, Germany and Austria experienced very large flows from Eastern Europe as well.

As is well known, this period of rising immigration of unskilled workers coincides with a period of strong deterioration of the relative (and possibly the real) return to native unskilled labour in nearly all industrial countries (Levy and Murnane, 1992; Davis, 1992; Blackburn and Bloom, 1995). While much of the research on the causes of this phenomenon has focussed on demand-side factors, with special emphasis on international trade and skill-biased technical change, unskilled immigration has received a considerable amount of attention as a possibly relevant supply shock. However, unlike the case of the relationship between international trade and labour market outcomes, where there is considerable disagreement on the facts, the overwhelming majority of empirical studies agree that there is essentially no statistically significant effect of immigration on labour market outcomes, with the possible

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[1]Carter and Sutch (1998), Hatton and Williamson (1998), and Sassen (1999) emphasize that large scale migration is not a new phenomenon, and was arguably quantitatively more significant in earlier periods. However, as Sassen (1999) points out, the development of democracy, nationalism, and welfare states have made immigration a politically more difficult, and potentially more explosive, issue in contemporary times than in earlier times.

[2]The statistics in this paragraph are drawn from Zlotnik (1999).

exception of the least skilled domestic workers (i.e. that small share of the work force that are high school dropouts).

The apparent occurrence of a large-ish supply shock with minimal economic effect has produced a sizable literature, primarily among labour economists, attempting to either account for the measured smallness or to generate larger numbers. While there is fairly widespread agreement on the smallness of measurable effects of immigration, the interpretation of this fact is a matter of some considerable dispute. We will first consider accounts that attempt to retain the main structure of the labour theoretic framework involving primarily issues of internal migratory response to international migration or the labour market microstructure issues like the possible presence of segmented labour markets. Where the inability to consistently identify significant effects from immigration was seen by some labour economists as something of a crisis, trade economists have been quick to suggest that this finding is, at least *prima facie*, consistent with standard trade theoretic models. We conclude the paper with a brief discussion of the theoretical basis for this claim.

II. How Labour Economists Have Evaluated the Effects of Immigration

In this section of the paper we discuss some of the major findings about immigration and labour markets that have been uncovered in recent research by labour economists. As with our discussion of the impact of international trade on the labour market (Gaston and Nelson, 2000), our primary focus here is on the contribution of immigration to the growing inequality experienced in many OECD countries during the 1980s, and the implications of that experience for future policy. In this section we consider in some detail empirical research by labour economists on the link between immigration and labour market outcomes (primarily wages). Contemporary empirical research on the labour market effects of immigration has grown quite large since its development in the early 1980s. We will divide this research into 2 broad categories: production function based studies; and regression analysis in the supply-demand-institutions (SDI) framework. As we noted in the introduction, the most striking result from that research is how small are the measurable effects of what is a fairly sizable labour market shock.

Before proceeding with this discussion we comment briefly on what may be the best known gross distinction used to characterize this literature: area studies *versus* factor content studies (Borjas, Freeman, and Katz, 1997). The problem is that the label is misleading. Virtually all labour theoretic frameworks apply a factor content based approach–i.e. it is change in relative supply (immigration into a market) that generates the change in labour market outcomes. The issue is actually about *level of analysis*. That is: how large must the geographic unit (i.e. area) be such that observations on supplies and prices of various classes of labour are independent? As we shall see, there are good reasons for believing that geographic units like standard metropolitan statistical areas (SMSAs) or states are linked in ways that are inconsistent with cross-sectional observations being independent draws from some distribution, but it is not at all clear that the statistically optimal level of analysis is the nation. There is considerable evidence that national borders have economic effects, but, by the same token, there is also considerable evidence that quite local labour markets take significant periods of time to fully adjust to macro shocks.[3] On balance, it is not clear to us that there is a clear reason to prefer one level of analysis to another. Level of analysis is always an important research decision, but this does not strike us as an essential distinguishing aspect in this body of research.

II. A. Production Function Based Methods

The most straightforward analytical framework involves selecting a specific functional form for an aggregate production function, estimating that function on cross-sectional data, and testing hypotheses on the degree of substitutability or complementarity between inputs.[4] In addition, elasticities of derived demand can then be used to carry out policy experiments. If we start with aggregate production function $y = f(z)$, $z = \{z_1, ..., z_m\}$, we seek to calculate the Hicksian partial elasticities of complementarity between any two of the inputs i and k as:

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[3]See Helliwell (1998) for a useful overview and extension of research on the economic effects of national borders. On local labour markets see Topel (1986), Blanchard and Katz (1992); and Bound and Holzer (2000). White and Mueser (1988) provide a very interesting discussion of the implications of level of analysis for studies of domestic migration.

[4]Production functions can also be estimated using time series data, but in that case one must be concerned with technological change, certainly a concern in the apparently technologically dynamic 1980s. The equivalent assumption, that all regions within the same country have access to the same technology set seems considerably less demanding.

$$\varsigma_{ik} = \frac{f\, f_{ik}}{f_i\, f_k}, \ \forall i, k \in I, \tag{1.1}$$

where we have used subscripts to denote partial derivatives. Following Hicks (1970; also see Sato and Koizumi, 1973), *i* and *k* are called *q-complements* if $\varsigma_{ik} > 0$ and *q-substitutes* if $\varsigma_{ik} < 0$.[5] Because it is easier to interpret the quantity elasticities of inverse input demand,

$$\eta_{ik} = \frac{\partial \ln w_i}{\partial \ln z_k}, \tag{1.2}$$

these are usually calculated using the relationship:

$$\eta_{ik} = \varsigma_{ik}\theta_k, \tag{1.3}$$

where θ_k is the distributive share of input *k*.

In carrying out work of this sort, investigators must select a functional form that does not prejudice the conclusion from the start. In particular, we would like the data to determine the values of the elasticities defined in (2) and (4). Thus, the commonly used Cobb-Douglas and CES forms will be inappropriate for any input vector with more than two arguments. As a result, investigators have generally used one or another of the flexible functional forms.[6] In addition to selecting a specific functional form, the other major choice in this body of research involves the definition of the input vector. Broadly speaking, there are two approaches: one defines the input vector in terms of observable characteristics (e.g. gender,

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[5]A pair of inputs (z_i, z_k) are *q-complements* if an increase in the endowment of *k* causes an increase in the wage of *I*, w_i; they are *q-substitutes* if the increase in z_k produces a fall in w_i. Hammermesh (1993) provides a clear discussion of these concepts.

[6] A functional form is *flexible* if it can approximate any arbitrary, twice continuously differentiable function in the sense that its parameters can be chosen such that its value, gradient, and Hessian equal the corresponding magnitudes for the arbitrary function at a given point. Lau (1986) provides an excellent discussion of the issues that arise in choosing functional forms for empirical analysis. Chambers (1988, Chapter 5) is a somewhat more elementary discussion, with a strong emphasis on application.

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age, immigrant status, etc.); while the other seeks to identify production relevant characteristics (e.g. quantity of human capital).

In the first paper using this approach, Grossman (1982) used cross-sectional data for 1970 to estimate a translog function of native workers, first generation immigrants, second generation immigrants, and capital. She finds that both first and second generation immigrants substitute for native labour, but that second generation immigrants are much closer substitutes for natives, and that new immigrants are closer substitutes for second generation immigrants than for natives. In addition, Grossman finds that capital is complementary with each type of labour, but that this complementarity is strongest with first-generation immigrants and weakest with natives. Grossman's analysis concludes with a policy simulation using the relationship in equation (3) to calculate own- and cross- elasticities to study the effect of a 10% increase in the number of legal immigrants in the labour force on a short-run equilibrium in which native wages are fixed (and thus adjustment occurs on the employment margin) and a long-run in which all wages are flexible. In the short-run, native employment falls by 0.8%, second generation wages fall by 0.06%, first-generation wages fall by 2.2%, and the return to capital rises by 0.2%. In the long-run, wages are flexible, so all markets clear: native wages fall by 1%, second generation immigrant wages fall by 0.8%, first-generation immigrant wages fall by 2.3%, and the return to capital rises by 4.2%.[7]

In an important series of papers, Borjas (1983, 1986a, 1986b, 1987) uses a number of data sets from the 1980s to study different disaggregations of labour in the context of a generalized Leontief production function. Depending on the particular breakdown of labour (e.g. by gender, race, and immigration status), immigrants tend to be complements to some native labour and substitutes to others, though in all cases these effects are small–except for the

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[7]In related studies, Bürgenmeier, Butare, and Favarger (1991) estimate a translog function of immigrant labour, native labour, and capital using Swiss time series data from 1950-1986, while Akbari and DeVoretz (1992) estimate a translog function on an industrial cross-section based on Canadian data for 1980. In addition to finding qualitatively similar results on the pattern of complementarity between factors, the Swiss study finds evidence of a positive relationship between immigration and capital accumulation. At the economy-wide level, the Canadian study finds no significant effect of immigrants–i.e. all Hicksian elasticities of complementarity between immigrants and natives are insignificantly different from zero. However, when the sample is restricted to labour intensive industries only, the Canadian study does find evidence of labour displacement as a result of immigration.

effects of immigrants on other immigrants of the same type, for whom the effects can be sizeable and negative. Given Borjas' more recent position as a leading opponent of immigration and searcher for large effects, it may be worthwhile to quote his own summary of this, and other, work circa 1990:

> the methodological arsenal of modern econometrics cannot detect a single shred of evidence that immigrants have a sizable adverse impact on the earnings and employment opportunities of natives in the United States. (Borjas, 1990, pg. 81).

In particular, Borjas fairly consistently finds that, while immigrants may be substitutes for white native born men, and thus increased immigration may have had a small negative effect on their labour market outcomes, immigrants are found to be complements to black native born men who, thus, may have gained from increased immigration.

This approach is also used to examine the effects of legal Mexican immigration on labour market outcomes of Hispanic natives (King, Lowell, and Bean, 1986) and illegal Mexican immigration on a wide variety of labour groups (Bean, Lowell, and Taylor, 1988) with essentially the same results: the first study finds evidence of complementarity, suggesting that Mexican immigration may have a positive effect on the wages of native born Hispanics; and the second study finds effects of legal immigration like those in Borjas, and finds that illegal immigration may have a small negative effect on white, non-Hispanic workers, but essentially no effect on native Hispanic workers.

The research we have considered to this point focussed on immigration status, among other things, as a production-relevant fact. Rivera-Batiz and Sechzer (1991) and Gang and Rivera-Batiz (1994), however, argue that there is no particular reason to believe that immigrant status, or race or gender, is directly production relevant. They prefer, instead, to assume that individuals with identical bundles of production relevant traits will receive the same wage. As a result their strategy involves estimating a translog production function of education, experience, and unskilled labour to derive the relevant Hicksian elasticities, and then using data on the skill composition of immigrants versus natives to derive distributional effects. Like Borjas and Bean *et al*., they use individual data sorted into local market areas to

estimate, like Grossman, a translog production function, and then use equation (1) to get the Hicksian elasticities of complementarity, and (3) to get the relevant factor demand elasticities. In the first stage they find, for both US and European data, that own supply elasticities are negative, as expected, and that the cross-elasticities imply that unskilled labour, education, and skill are all complements for one another (i.e. $\varsigma_{ik} > 0$ for $i \neq k$). In addition, own elasticities are all estimated to be considerably larger than cross-elasticities. The authors then construct skill inventories of immigrant and native groups and use those, along with the estimated elasticities, to compute composite elasticities of complementarity that summarize this information. As with other work that we have reported, there are a variety of sign patterns, but "the impact of *all* the immigrant groups on *all* the native-born groups are small in absolute magnitude" (Rivera-Batiz and Sechzer, pg. 106). The largest effect is that of Mexican immigrants on Mexican-Americans, where an increase in Mexican immigration of 10% will result in slightly less than an 1% fall in wages of Mexican-Americans (with a similar effect on native black labour). Similarly small results are found for the European case in Gang and Rivera-Batiz.

The production function approach receives its most sophisticated treatment to date in a series of papers by Michael Greenwood and Gary Hunt with a variety of colleagues. In Greenwood and Hunt (1995), the authors are interested in examining a variety of adjustment channels beyond change in wage. For input demands, they estimate a translog cost function on SMSA level data for 1970, and find immigrant labour to be a substitute for domestic labour. In addition, they estimate labour supply functions and aggregated output demand functions for the local markets. With these results they construct a large number of simulations permitting adjustment via flexibility in native labour supply (via both variable participation rates and internal migration) and changes in demand for final output, as well as adjustment along a given isoquant. As with the previous studies, the wage, and now labour force participation, effects of immigration are uniformly small and, perhaps not surprisingly the magnitudes of effects generally fall with the opening of additional channels of adjustment. The final output demand channel in particular seems to have a consistent effect of reducing the wage effects of immigration (or even making the effects on natives positive). These results can be seen to be closely related to the trade theoretic claim that, with multiple sectors the existence of

adjustment at the output mix margin will generally lead to smaller effects (factor-price insensitivity).

By the mid- and late-1980s, researchers working in applied production analysis had begun to recognize that standard flexible functional forms (including both the translog and generalized Leontief forms) could fail to satisfy concavity, but that flexibility may be destroyed if concavity is imposed globally (Diewert and Wales, 1987). Greenwood, Hunt, and Kohli (1996) begin their analysis by pointing out that virtually all of the studies we have reviewed to this point present results indicating the presence of failures of concavity, in addition they estimate CES, translog, and generalized Leontief cost functions on a common data set to illustrate violations. As a result, they conduct their analysis using the symmetric normalized quadratic form, developed by Diewert and Wales (1987), that permits curvature conditions to be imposed globally without endangering flexibility. The authors calculate the Hicksian elasticities of complementarity and find that native labour and immigrants are q-substitutes, while all other input pairs are q-complements. Thus, an increase in immigrants would lower the wage of native workers, and raise the wage of non-recent immigrants and capital, but these effects are quite small. For example, a 10% increase in the supply of recent immigrants would reduce the wage of native-born labour by 0.96%. The effect of this change on other recent immigrants, however, is quite large.

Finally, Greenwood, Hunt, and Kohli (1997) mix the approaches of Grossman and Borjas with that of Rivera-Batiz by disaggregating native and immigrant labour into four skill categories each (based on earnings), as well as capital, and estimating a symmetric normalized quadratic cost function on a cross-section of SMSAs.[8] Not surprisingly, given the number of factors, there is quite a variety of q-substitutability and -complementarity, but unskilled immigrants appear to be strong q-substitutes for low- and medium-skilled native

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[8]In a study of the impact of low-skilled migration from Mexico, Davies, Greenwood, Hunt, Kohli, and Tienda (1998) estimate a symmetric normalized quadratic production function in which the arguments are: low-skilled natives divided by gender and ethnicity (Mexican, non-Mexican); native high-skilled males and females (one category); foreign born, low-skilled Mexicans; foreign born, low-skilled non-Mexicans; and capital. As in the previous studies, the authors find that in both 1980 and 1990 immigrants have negative effects on the native born, but that these effects were small. The effects on other immigrants were found to be large. Furthermore, whatever might be the effects of trade and factor mobility within the US, the effects are larger in areas of high immigrant concentration.

labour, and *q*-complements for unskilled native labour. Once again, however, the authors are unable to find any evidence that unskilled immigration leads to large changes in the income distribution or in employment opportunities, with the exception of the effect on other unskilled immigrants.

Before turning to the more widely used SDI regression approach, we briefly note a structural approach used by trade economists which could be seen as a multisectoral generalization of the production function approach. Following original work by Burgess (1974), empirical trade economists have exploited duality theory to estimate comparative static effects of trade by treating trade as a direct argument in a GNP function.[9] The marriage of this approach to trade modelling to the production theoretic modelling of immigration seems obvious, but has only rarely been done. Wong (1988) works with an indirect trade utility function that is, itself, a function of the GNP function. This function is estimated, in translog form, on prices for home produced durable goods, home produced nondurable goods and services, and imported goods and services, and endowments of capital, land, and labour, for a number of years between 1948 and 1983. Foreign capital and labour are taken to be perfect substitutes for the domestic factors, so the comparative statics on the indirect utility function can be used to generate the relevant elasticities. These elasticities are all small. Kohli (1993, 1999) develops this sort of analysis in considerably greater detail. Specifically, using annual Swiss data from 1950-1986, Kohli (1999) estimates the translog cost function associated with the primal GNP function and a *z* vector containing capital, home labour, immigrant labour, and imports.[10] Thus, where Wong treats home and immigrant labour as perfect substitutes, Kohli is able to test this relationship. In fact, Kohli finds that home and immigrant labour are both Allen-Uzawa and Hicks *q*-substitutes, though not perfect substitutes. Commodity imports and immigrant labour are found to be both Allen-Uzawa and Hicks *q*- complements.[11] Once

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[9]The underlying idea is to treat trade as an input to final GNP under the argument that virtually all goods in trade must be processed further for final sale. See Kohli (1991) for an excellent development of the theory, econometrics, and results from this research.

[10]Kohli (1993) directly estimates a symmetric normalized quadratic GNP function on the same Swiss data. The results are broadly the same, increased immigration reduces home wage, but only weakly; and trade and immigration are found to be complements.

[11]Interestingly, imports and capital are Allen-Uzawa substitutes, but Hicks *q*-complements.

again, the magnitude of the estimated effect of immigration on native wages is negative, but quite small. However, Kohli simulates a short-run model in which the wage is downward inflexible, and finds the effect on home labour displacement to be large.

Overall, econometric research which explicitly exploits production theoretic structure, tends to find strong substitutability between immigrants and other immigrants of the same vintage and national origin and, otherwise, widely varying patterns of complementarity and substitutability between immigrants and natives. More importantly, the elasticities between immigrant and native labour are consistently small, and are smaller yet when other channels of adjustment than the wage are explicitly permitted.

II.B. The SDI Regression Approach to Estimating the Wage Effects of Immigration[12]

The labour economists' standard approach to wage inequality and income distribution is firmly rooted to an analysis of "SDI" or "supply, demand and institutions" (Freeman, 1993, pp. 44-49). To evaluate the labour market effects of immigration, identifying how the immigration of workers with differing skills affects the relative supply of labour can be viewed as a necessary first step. In turn, the skill group characteristics of new immigrants are affected by the returns to skill as well as the distribution of earnings in both the source and host countries. Finally, labour market institutions are important because they affect the degree of wage inequality, the structure of wages and the labour market response to shocks.

Borjas *et al*. (1997) constitutes a prominent example of this type of approach. What they term the 'aggregate factor proportions approach' involves regressing the ratio of skilled wages to unskilled wages in year *t*, on the relative labour supply of the two types of labour. Borjas *et al*. (1997) find that immigration affected certain groups of workers more so than others. Specifically, immigration may have been responsible for the decline in the earnings of unskilled native workers that occurred during the 1980s. Their paper has contributed to the view that, relative to the effects of growing international trade with less developed countries,

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[12]There is a parallel literature applying regression analysis to unemployment. We focus on the wage results primarily because of the close link to the theory. We simply note here that the primary conclusions of this section–i.e. small to no effects, except on migrants of similar origin and vintage, and the least skilled native workers–holds as well for unemployment.

immigration may have had a proportionately larger negative impact on the earnings of unskilled U.S. workers.

A qualitatively similar approach is used to derive estimating equations for regional unemployment or wages. For example, Altonji and Card (1991) and LaLonde and Topel (1991) estimate wage equations taking the form:

$$w_j = \gamma_\lambda \lambda_j + \beta_X X_j + \upsilon_j, \tag{1.4}$$

where j indexes the local labour market, w is the logarithm of the wage for a particular skill group, X is a vector of control variables and, as above λ is the proportion of immigrants in the local labour market. In contrast to the above study by Borjas, *et al.* (1997), these studies find scant evidence that recent waves of immigration have disadvantaged U.S. workers.

To eliminate region-specific fixed effects, due to ethnic enclave effects, for example (see Bartel, 1989), first-differencing is often used. More generally, if the immigrant share in market j is correlated with unobservable variables only through a time-invariant individual fixed effect, then estimating fixed effects regressions may be appropriate (e.g., see Altonji and Card, 1991; Topel, 1994a, 1994b). LaLonde and Topel (1991) estimate this sort of regression in both levels and differences and find that the estimates of the effect of immigration produced by the two methods are nearly identical, i.e., the wage effects are negligible.

Unfortunately, fixed effects estimation is not a cure all for most sample selectivity and endogeneity problems. In the case of immigration and wages, the very nature of sorting on unobservable variables suggests that the migration decision of individuals may involve a process of learning about what is their correct state (i.e., industry, occupation, location, etc.). We discuss the endogeneity and sample selection further below in connection with the instrumental variables and natural experimental approaches to the study of the impact of immigration.

Of course, these regression specifications are quite general. For instance, there have been many studies using the regression framework that have focussed on the importance of the

large increase in the relative supply of workers during the 1970s to the increasing wage inequality that occurred throughout the later 1980s and early 1990s. The increase in the U.S. workforce caused by the labour force entry of the baby boomers easily dwarfs the increase in the labour force caused by immigration. Welch (1979), Berger (1985), Murphy, Plant and Welch (1988) and Murphy and Welch (1991) are among the better-known U.S. studies. A common finding of these studies is that changes in cohort size associated with the Baby Boom generation did not have a significant impact on cohort earnings. Overall, supply-side changes in the United States were very quickly discounted as a candidate explanation for the increased dispersion in the income distribution in the United States during the 1980s.

Notwithstanding, the preceding findings on the effects of domestic labour supply shocks do not necessarily imply that all supply-side "shocks" are unimportant. In the current context, some authors claim that immigration may have been responsible for the decline in the earnings of unskilled native workers that occurred during the 1980s. The immigration issue has been increasingly seen as one of "distribution" rather than "efficiency" (see LaLonde and Topel, 1997). Freeman (1998, p.110) argues that immigration may have had substantially larger effects on native unskilled workers than increased international trade with low-income countries, for instance. During the 1980s, a period during which wage inequality rapidly increased in the United States, immigration raised the supply of high school dropouts by approximately 25 percent, which far exceeds the increase in the "implicit labour supply" of such workers attributable to trade. Furthermore, Borjas *et al.* (1992, 1997) conclude that the large increase in the number of unskilled immigrants explains about one third of the decline in the relative wage of high school *dropouts* during the 1980s. For the United States, wage inequality increased most in the West where the largest inflow of less-skilled immigrants was experienced (Topel, 1994a; 1994b).

In principle, changes in cohort quality can be analysed in the same way as changes in cohort size. Borjas (1994) considers the declining cohort quality of recent waves of immigrants to the United States to have been the result of the shift in U.S. immigration policy, specifically the passage of the 1965 Immigration Act. However, his findings of decreasing cohort quality have recently been questioned by Butcher and DiNardo (1998) who focus on changes in the wage distribution through time. Using the methodology developed by DiNardo *et al.* (1996),

they investigate the counterfactual of what the wage distribution would have looked like for new immigrants if they had faced the wage distributions from different eras. They find that earlier immigrants would have had wages much more similar to today's new arrivals, if they had faced the present day prices for their skills.[13] Race and ethnicity, and not the changing education levels of the new immigrants, explain much of the change in comparative economic fortunes of recent immigrants once wage structure changes have been held constant. The point, as also stressed by LaLonde and Topel (1991), is that recent cohorts of immigrants will look as if they do worse, even if they have the same set of characteristics as earlier cohorts of immigrants, if the distribution of wages has become more dispersed and if the new immigrants lie near the lower tail of the income distribution.

The use of regressions to uncover the wage effects of immigration by regressing immigrant shares and other controls on wages or relative wages poses many familiar problems. Among the more prominent concerns with multiple linear regression analysis is the omission of important right-hand side variables. Biased estimates result if relevant characteristics or controls are not included in the regression equation. Similarly, how do various characteristics that are included in a model specification interact with one another? More generally, empirical work usually forces researchers to assume an appropriate functional form in order to reduce the problem at hand to one of estimating the parameters of interest. For example, would a linear function involve a serious mis-specification loss? As the previous section revealed, there is a wide range of functional forms from which to choose and so the robustness of parameter estimates is invariably an issue that needs to be confronted.

Variable (mis-)measurement and interpretation also pose problems. For instance, when does a migrant finally assimilate and become a native? The latter problem is particularly obvious one in those countries that are essentially composed of older generations of immigrants (e.g., Australia and the United States).[14] More formally, there is the issue of weak separability (see

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[13]With similar implications, albeit from a different perspective, Friedberg and Hunt (1995) note that "composition problems" make it difficult to ascertain the impact of immigration on wage inequality. For example, they argue that including the newly arrived waves of less-skilled migrants in inequality calculations is likely to bias the conclusion towards finding greater inequality in the United States.

[14]Zimmermann (1995) reminds readers of the literature that the European research on immigration has more to do with the effects of possessing citizenship. Unlike the U.S. literature, which has tended to focus on the

Berndt and Christensen, 1973) of the various types of labour – not just of skilled versus unskilled labour, but also of native workers versus immigrant workers as well as first generation migrants versus second and later generations of migrants.

One of the most important difficulties in the empirical immigration and labour market effects literature is the likely possibility that labour supply functions are not independent of wages. The problem is reminiscent of the difficulties faced by the labour economists who attempted to uncover the effects of trade liberalisation on relative wages (see Gaston and Nelson, 2000). Economic commonsense suggests that the immigrant labour force share is endogenous. To make the endogeneity issue transparent, consider a simple 2-equation model:

$$w_j = \gamma_\lambda \lambda_j + \beta_X X_j + \upsilon_j$$
$$\lambda_j = \gamma_w w_j + \beta_R R_j + \nu_j,$$

(1.5)

where X and R are (exogenous) scalars and all variables are expressed in deviations from their means. As before, j indexes a local labour market. The sign of the OLS bias is given by:

$$\text{plim} \gamma_\lambda^{OLS} - \gamma_\lambda = \left[\frac{\sigma_X^2}{\sigma_X^2 \sigma_w^2 - \sigma_{X\lambda}^2} \right] \cdot \left[\frac{\gamma_w \sigma_\upsilon^2 + \sigma_{\upsilon\nu}^2}{1 - \gamma_w \gamma_\lambda} \right].$$

(1.6)

It is not possible to argue a priori that the sign of the bias is either positive or negative. For illustration, suppose $\sigma_{X w}^2 = \sigma_{\upsilon\nu}^2 = 0$ and that $\gamma_w > 0$ (i.e. higher relative wages are associated with higher relative supply). If the "true" effect of a higher migrant share of unskilled workers is to depress unskilled wages, i.e. $\gamma_\lambda < 0$, then the bias is positive. That is, a failure to account for endogeneity will bias upward (i.e. toward zero) estimates of the impact of immigrants on wages.

However, note that if we are estimating some variant of the aggregate factor supply model, strictly speaking, our focus is on wage inequality. Furthermore, in many of the early studies

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effects of newly-arrived immigrants on native workers as well as on earlier generations of immigrants, the European data do not distinguish individuals as foreign-born or not.

in this literature, λ is simply taken to be the share of migrant labour in market j. Under this interpretation, it is no longer obvious that $\gamma_w > 0$. Models of immigrant worker self-selection, based on the pioneering work of Roy (1951), are extremely illuminating here.

Workers with high earnings potential are likely to migrate from a country with an egalitarian wage structure (where they cannot easily make high earnings), while workers with low earnings potential are especially likely to migrate from a country with great wage inequality. In terms of source country characteristics, equality of the income distribution encourages what is termed "positive selection bias".[15] Negative selection bias results when source countries have unequal income distributions and therefore migrants are likely to be the least skilled.[16] Recent waves to the United States tend to have been increasingly drawn from the latter group (Borjas, 1994). Immigrants are mobile, but they have tended to cluster in cities where their fellow countrymen reside. The clustering effects tend to dominate such economic incentives as differences in unemployment rates or welfare benefits across areas (Bartel, 1989; Bartel and Koch, 1991). The effects of clustering are borne by the gateway cities, while the geographic concentration tends to reduce economic progress and the rate of assimilation. Of importance for the present discussion is that, given that the primary adverse wage impact of new immigrants is upon previous generations of migrants, the clustering effect may imply $\gamma_w < 0$. If the effect of clustering is sufficiently strong, then it is possible that OLS estimates are biassed downwards, and not upwards.[17] Friedberg's (1997) findings are consistent with this line of argument. She studies the impact of Russian migration on occupational wages in Israel and finds that IV estimates are higher than OLS estimates. That

[15] In fact, a point often overlooked is that host country labour market conditions are absolutely central to the migration decision. For example, Hanson and Spilimbergo (1999a) found that attempted illegal immigration from Mexico is *extremely* sensitive to changes in real wages in Mexico.

[16]Interestingly, increasingly negative self selection produces labour market outcomes in both the source and host countries similar to the picture of the effects of outsourcing on wage inequality painted by Feenstra and Hanson (1996, 1997). That is, if workers emigrating from Mexico are relatively high skilled from Mexico's viewpoint and unskilled from the United States' viewpoint, then wage inequality tends to rise in both countries.

[17] Friedberg and Hunt (1995) make a related criticism of Goldin's (1994) findings. Using data for 1890 to 1923, Goldin found a significant negative correlation between the percentage of foreign-born residents and wages in U.S. cities. However, this may be a 'composition' effect, i.e., if immigrants earn lower wages that natives, then even if immigrants have *no* effect on native wages, they tend to be clustered into cities with lower average wages.

is, rather than immigrants choosing occupations based on them offering higher wages, she finds evidence of occupational immobility (so that $\gamma_w < 0$). That is, immigrants, irrespective of their skill levels are confined, initially at least, to low-paying occupations. Hence, OLS estimates overstate the impact of immigrants on wages.

Handling the endogeneity problem is the motivation for the use of the instrumental variables (IV) approach (e.g., Altonji and Card, 1991 and Friedberg, 1997) and the quasi-experimental approach in the labour literature (e.g., Card, 1990 and Hunt, 1992). Altonji and Card (1991) investigate the impact of immigrants on low-skilled native workers. They relate changes in the earnings and employment of low-skilled natives across cities to changes in the migrant population. As discussed, the problem is that the immigrant flows are likely to be correlated with current labour market conditions. Hence, Altonji and Card instrument the change in immigrants with the size of the immigrant enclave in an earlier period. They argue that the size of the immigrant enclave in the past is likely to affect immigrant flows but is not necessarily correlated with current demand shocks. In other words, the IV approach attempts to use only the variation in immigrant flows associated with variation in enclave "pull" and not that associated with current demand shocks. Interestingly, Altonji and Card's estimate of γ_λ is one of the most negative. Notwithstanding, they conclude that immigrants and natives face little competition from one another. They find that there is some industry displacement from low-wage immigrant intensive industries; but still, the implied elasticities are small.[18] Despite these mobility effects, the effects on employment and unemployment rates are virtually zero.

Due to the substantial difficulties associated with choosing "good" instruments (e.g., see Nelson and Startz, 1990; Bound, Jaeger and Baker, 1995), considerably more weight in this branch of the literature has been attached to the results of the quasi- or natural experiments. Natural experiments occur when exogenous variation in independent (explanatory) variables (that determine "treatment assignment") is created by abrupt exogenous shocks to labour markets (Meyer 1995). For example, natural experiments can arise due to institutional

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[18]Friedberg and Hunt (1995) note that Altonji and Card's "large and negative" estimates imply that a 10 percent increase in the percentage of foreign-born in a local labour market implies a minuscule 0.86 percent reduction in wages.

peculiarities (e.g., Vietnam-era draft lotteries) or due to exogenous policy changes that affect some but not other groups (e.g., changes in policies in some states but not others).[19]   In the latter case, Hanson and Spilimbergo (1999b) examine how enforcement of the U.S.-Mexico border is affected by changes in illegal immigration. They find that the equilibrium level of border enforcement varies inversely with relative demand shocks (and consequently, demand for undocumented labour). In other words, the authorities relax border enforcement when the demand for undocumented workers is high.

Natural experiments are most useful in situations in which econometric estimates are ordinarily biassed because of endogenous variables due to omitted variables or to sample selection.   The basic approach involves a comparison of changes for "treatment" and "control" groups (i.e., differences-in-differences). This can be accomplished in a components of variance scheme (time effects, location effects, treatment group effects, interaction terms and so on) or by using an IV approach in which one instruments for the treatment dummy variable with the natural experiment indicator variables. In this sense, the IV and natural experimental approaches are qualitatively equivalent.   With IV, legitimate instruments generate a natural experiment that assigns treatment in a manner independent of the unobserved covariates. The advantage is that the source of the identifying information is transparent.

Occasionally, data are available for the time period before and after a "treatment" (in our case, the treatment is an immigration shock) for a group that does not receive the treatment but experiences some or all of the other influences that affect the treatment group. At the very heart of the quasi-experimental approach to the immigration and labour market literature are the non-policy and non-institutional shocks that can be considered truly exogenous to existing labour market conditions in the destination country (e.g., Baby Boom, Black Death, Mariel Boatlift). That is, consider:

$$w_{jst} = \alpha + \beta D_s + \tau D_t + \gamma D_{st} + \varepsilon_{jst}, \tag{1.7}$$

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[19]Hamermesh (2000) argues that, unlike "acts of God", treating changes in the legal environment as exogenous is rarely convincing.

where D_t can be thought of as a time period dummy, D_s is defined as above, and $D_{st} = 1$ if $D_t = Ds = 1$, and 0 otherwise. The key idea is that   summarises the way in which both treatment and non-treatment groups are influenced by time (e.g. such things as macroeconomic conditions and regional growth trends). The time-invariant difference in overall means between the groups is captured by β. D_{st} indicates membership of the experimental group after it receives the treatment and γ is the true causal effect of the treatment on the outcome for this group. Again, the key identifying assumption is that $E(\bullet_{jst}| D_{st}) = 0$.

Note that γ would be 0 in the absence of the treatment (i.e. the immigration shock). An unbiased estimate of γ can be obtained by the differences-in-differences estimator, i.e.:

$$g = \left(\bar{w}_{11} - \bar{w}_{01}\right) - \left(\bar{w}_{10} - \bar{w}_{00}\right), \tag{1.8}$$

where the first subscript is t and the second is for treatment s. Without question, the most cited natural experimental paper is Card (1990) that examines the impact of the Mariel Boatlift on Miami's labour market. In his paper, the first bracketed term in equation (8) represents the difference in wages for black workers in Miami before and after the Boatlift.[20] The second bracketed term is the wage difference for the same types of workers in a group of four comparison cities. The latter cites were chosen because they had relatively large populations of black and Hispanic workers and because they exhibited patterns of economic growth similar to those observed in Miami over the late 1970s and early 1980s. As is well known, despite the dramatic and sudden 7 percent increase in the size of Miami's work force, Card is unable to detect any adverse impact on the wages or unemployment of less-skilled workers.

There are two notable quasi-experimental studies for Europe. Hunt (1992) examines the impact on wage differentials in France in 1968 of the influx of *pied noirs* from Algeria during the early 1960s; and Carrington and de Lima (1995) study the return of Portuguese

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[20]Card conducts a similar analysis for Hispanic workers, as well. Also, in addition to wages he uses the same methodology to examine whether the Boatlift had any effect on the unemployment rates of less-skilled workers.

colonialists from Africa and examine the wage effects across the provinces of Portugal. Consistent with Card's findings, these authors were unable to discern adverse wage effects for native workers.

Although subject to varying interpretations, the finding of small local labour market effects has been remarkably robust and in line with the findings from the econometric studies. LaLonde and Topel (1991) estimate the elasticities of complementarity between immigrants and natives and between new immigrants and older cohorts of immigrants and find both to be very small. Taken in conjunction with their analysis of wages and earnings changes in local labour markets, they conclude that the wage effects of immigration are "quantitatively unimportant". Based on studies currently in print, it appears to us, that such a conclusion is inevitable.

One would expect that in the face of such a huge mountain of evidence this would be the end of the story. Of course, even the briefest excursion through the recent literature reveals that the debate is far from having run its course. The attention of those intent on identifying large native labour market impacts has turned to explaining what the small statistical effect "really means". One explanation has highlighted the possibility that immigrants locate to areas where jobs are expanding anyway.[21] Another is that the internal migration by natives offsets the increased supply of immigrants (Filer, 1992; Borjas, 1994; Borjas *et al.* 1997). The insignificant wage effects may simply be the result of factor price equalisation across U.S. regions (see the next section). In the case of the "outwards native migration" argument, the punch-line is that the small local labour market effects conceal, and may considerably understate, the negative impact of migrants on native workers. In the latter case, at least, this is now thought not to be the case. Card (2001) finds that the inter-city migration decisions of natives and older immigrants are largely unaffected by inflows of new immigrants. Moreover, Card and DiNardo (2000) find no evidence of selective out-migration by natives in response to immigrant inflows at particular locations.

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[21]Once again, the issue is the econometric one of handling the possibility of endogeneity. If immigrants choose their destination locations or occupations based on wage growth and the growth of job opportunities, rather on wage levels, then controlling for the endogeneity problem appropriately requires the use of panel data.

Another possible reason for the insignificant cross-sectional impacts of immigration on wages relates to our discussion of dimensionality and margins of adjustment, given that the industrial composition of output may change without factor price effects. Hanson and Slaughter (1999) document the rapid growth in apparel, textiles, food products and other labour-intensive industries in California after the arrival of Mexican migrants. They focus on state-specific endowment shocks and state-specific wage responses. They show that the state output-mix changes broadly match state endowment changes and that variation in state unit factor requirements is consistent with factor price equalisation across states. States absorb regional endowment shocks through mechanisms other than changes in regional relative factor price changes. This is consistent with the findings of Blanchard and Katz (1991) that indicate that wages and income per capita converge for American states. However, Blanchard and Katz also find that employment performance diverges, i.e., shocks to employment grow and persist.[22] Overall, this is consistent with the view that small local labour market effects may be consistent with somewhat larger aggregate labour market effects.

The broad conclusion from the first large NBER project on immigration and trade was that immigration had a relatively smaller area impact than increased import penetration on native labour. Overall, the labour market was thought to easily adjust to migrant inflows, absorbing immigrants with little redistributive losses to natives (see Abowd and Freeman, 1991). This conclusion was largely, and somewhat surprisingly, reversed by the second NBER project (Borjas and Freeman, 1992). While the wage and employment effects for natives in local labour markets are small, it was argued that certain groups of workers have been adversely affected by immigration. The augmented factor supplies of less-skilled workers, due to either the effect of trade with low-income countries or from the immigration of workers from developing countries, were thought to have contributed to the poor outcomes of less-educated American workers during the 1980s and early 1990s.

The finding that certain groups of workers may have been adversely affected by immigration is evident for some European studies as well. For example, De New and Zimmermann (1994)

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[22]Decressin and Fatás (1995) have similar findings for the regions of Europe. However, they show that changes in labour force participation rates bear proportionately more of the burden of adjustment in response to labour market disturbances.

find that greater concentrations of foreign workers in German industries during the 1980s were associated with small wage gains for white-collar workers, but relatively large wage losses for blue-collar workers.[23] Zimmermann (1995) attributes these findings to the greater labour market inflexibility, greater levels of unionisation and low labour mobility in Europe in comparison to the United States.[24] In the case of strong unions or wage inflexibility, the expectation is that immigration is associated with increases in native unemployment. In the case of labour immobility, equations (8) and (9) suggest that skilled wages increase and unskilled wages decrease when unskilled immigration increases.

It should, however, be noted that the results for Europe are quite mixed. For instance, Pischke and Velling (1994) find that immigration had no adverse wage or unemployment effects in German local labour markets. Similarly, Winter-Ebmer and Zweimüller (1996) using both OLS and IV estimation procedures find no detrimental immigration impact upon Austrian industry or regional wages.

Finally, we note that a number of studies have attempted to consider trade and migration at the same time. The simplest approach to examining the effects of trade and immigration takes an agnostic position on the nature of the relationship between trade and immigration, and simply includes variables measuring both in a wage equation.[25] Freeman and Katz (1991)

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[23]Specifically, De New and Zimmermann find that their IV estimates were substantially more negative than their OLS estimates (in fact, 15 times larger). On one hand, this result may be seen as being consistent with Friedberg's (1997) occupational crowding finding for Israel, discussed above. On the other hand, at a more practical level there is evidence of some instability in the coefficients of the industry level variables in the IV model specification. (De New and Zimmermann use industry dummies, industry growth rates and industry specific time trends as determinants of share of foreign workers by industry.) As the authors acknowledge, the issue of whether their instrumenting procedure has been able to fully control for the endogeneity of the foreign share of labour may have been insufficient.

[24] Interestingly, Zimmermann (1995) notes that there has been little impact of immigration on unemployment rates. The research on the effects of immigration on Australian labour market outcomes has instead focussed on the likelihood of adverse unemployment effects. With a heavily regulated labour market (compared to the United States, at least), the concern has been that labour market adjustments would occur through quantity (length of the dole queue) rather than through prices (wages). However, in surveying the literature, Junankar *et al.* (1998) conclude that immigration has not increased the Australian unemployment rate.

[25]Borjas, Freeman and Katz (1992, 1997) simulate a partial equilibrium labour market model in which an inelastic labour supply is shifted by a direct immigration shock and an indirect labour import shock calculated via the factor contents of commodity trade. Even in this framework, which is adopted to maximize the labour market effects of globalisation, the authors conclude (BFK, 1997, pg. 66): "The bottom line from our

estimate regressions of both hourly wage and annual hours on measures of change domestic demand, foreign demand, imports, and immigration (both stock and change), as well as a number of controls, on a cross-industry data set.[26] Changes in imports and immigration are negatively related to hourly wages and positively related to annual hours. However, the authors suggest that these regressions generate suspiciously large effects of immigration, leading to an argument that they are picking up the tendency of immigrants to move into low- and declining- wage industries (pg.246).[27] This explanation is consistent with the standard trade theoretic model, due to Mundell (1957), in which trade and factor mobility are substitutes. That is, sectors facing increasing competition from low wage (unskilled intensive) countries can slow the rate at which they decline by importing low wage labour directly.[28]

Similar methodologies have been applied in the cases of Germany and Austria. For the German case, Haisken-DeNew and Zimmermann (1999) use the German Socioeconomic Panel (SOEP) to estimate wage regressions on a variety of individual variables and region/sector specific trade deficit and foreigner share variables, in a random effects panel model for 1984-1992. In addition to carrying out the analysis on the sample of all workers, they also segment the sample by skill (under both job title and years experience definitions), by blue v. white collar. In all cases, they find that trade is negatively related to wage, and immigration (in all cases but one) positively related to wage.[29] The first finding parallels that of Freeman and Katz, while the second is directly contradictory. Because the immigration results are generally larger, and more precisely estimated for high-skilled workers, the authors

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simulations is that the economic impact of immigration is mainly redistributional and primarily affects a small group of the least educated U.S. native workers".

[26]These changes are calculated for 1958-1984. As a control, the authors also estimate these models on CPS data, with essentially the same result.

[27]This tendency is observed directly in a wide variety of research.

[28]By the logic of the Rybczynski theorem, the import of unskilled labour results in an increase in the output of the unskilled labour-intensive sector and a fall in the output of the skilled labour-intensive sector. Even if the relative endowment of skilled labour is rising as a result of domestic human capital accumulation, possibly driven by increased international competition, an increasingly unskilled labour-abundant immigration will slow down the rate of decline of the unskilled labour-intensive sector.

[29]The one exception is a statistically significant negative relationship between number of immigrants in a region/industry and the wages of low-skilled, white collar workers, where skill is defined by level of experience.

conclude that this is suggestive of complementarity between immigrants and high skilled workers. Consistent with Freeman and Katz' suggestion of a substitutive relationship between trade and immigration, however, is Haisken-DeNew and Zimmermann's finding that import-competing sectors employ a larger share of immigrant workers. Winter-Ebmer and Zweimuller (1999a) examine trade and immigration in a cross-section of Austrian workers, finding that immigration increases unemployment duration by a small amount, but has no statistically significant effect of probability of unemployment. In addition, they find no effect of trade on probability of unemployment or unemployment duration. In a related study of young workers, Winter-Ebmer and Zweimuller (1999b) find exports negatively related to unemployment (though exports to the CEEC are positively related), imports having no significant effect (though those from the CEEC have a negative effect), regional stock of immigrants makes unemployment more likely, but immigrants in the sector make it less likely. Again, these effects are generally small. Finally, Winter-Ebmer and Zimmermann (1999) present results, for both Austria and Germany, for changes in overall employment growth, native employment growth, and wage growth, as a function of changes in exports (to CEEC and rest of world), imports, and foreign share. In the Austrian case, immigration has essentially no effect on overall employment growth, and only small negative effects on native employment growth and wage growth. Imports also generally have a negative relationship to employment growth, with imports from the CEEC having a generally larger negative effect. For the German case there is evidence that overall immigration has a small negative effect on native employment growth and a small positive effect on wage growth, while immigration from Eastern Europe has a rather strong effect on native employment growth and a sizable positive effect on wage growth. The effects of growth in imports and exports are uniformly small, mostly insignificant, and perversely signed. Overall, these results are consistent with results reported above that immigration effects are small, even taking into account interactions with international trade.

In this section, we focussed on two of the more important "facts" that have seemingly gained widespread acceptance. First, that immigrant flows have small local labour market effects; and second, that immigration has affected certain groups of workers more so than others. To us, the first conclusion seems inescapable. The same cannot be said for the second. In the

case of the United States, such a conclusion seems an overly confident one to reach. Given the sheer size of the U.S. labour market and the quantity of unskilled labour, more broadly defined, it is unlikely that immigration (or trade) would have contributed to the overall increase in wage inequality observed in the United States during that particular period. On the other hand, as Rodrik (1998) notes, there may have been a fundamental change in the underlying demand for unskilled labour that is attributable to the increased availability of unskilled, migrant labour. As argued by Gaston and Nelson (2000), it may be the case that trade and immigration engender institutional responses that do leave some types of unskilled labour more vulnerable to economic shocks than others.

III. Trade Theory as A Guide to Interpreting Empirical Results[30]

For some labour economists, the results reported in the previous section have an air of paradox: how can a sizable supply shock fail to have sizable price (i.e. wage) effects?[31] This air of paradox can be dispelled, however, with a small change in theoretical perspective. It will be recalled that both the production function and SDI approaches, explicitly or implicitly, work with the same underlying theoretical model: a many-factor × one-final output, perfectly competitive economy. The virtue of this model, from the point of view of empirical work on labour markets, is the strong identifying restrictions that it generates for empirical work. With particular reference to the study of supply shocks, like immigration, perfect competition with one final good forces all adjustment to supply shocks through the factor-price. In this section, we will argue: 1) that moving to a framework identical to that used by labour economists except that there are at least as many industries as factors of production, eliminates the paradox; 2) that this dimensionality assumption is more *a priori* plausible than

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[30]Useful general surveys of the relationship between trade and immigration can be found in Ethier (1986, 1996), Wong (1995), Razin and Sadka (1997), and Venables (1999).

[31]Though, we note again, even larger supply shocks (e.g. the baby boom) produce relatively small wage effects. See Hammermesh (1993) for evidence that the estimated elasticities in the immigration case are not particularly different from those generally estimated. This provides some support for the notion that the search for large effects was driven, at least in part, by the large political effects of immigration: in particular the politics surrounding Proposition 187 in California, and anti-immigrant politics in Europe. Our standard political economy models take it that politics is driven by economic self-interest, so the presence of extensive political activity is taken to be indirect evidence of large economic effects. See Gaston and Nelson (2000b) for a discussion of this issue.

$m \times 1$ assumption used by labour economists; and 3) that there is some systematic evidence in favour of this approach.

Given the occasionally heated disputes between trade and labour economists on this question, it is important to be clear that the issue is presumption. That is, *as a first approach* to thinking about the impact of immigration on a well-defined labour market, what is the most sensible model for generating intuition. We will argue that the only matter of substance dividing these two broad approaches (labour and trade) is dimensionality. Both take complete and perfect markets to be a plausible baseline from which to begin the analysis of immigration.[32] Somewhat less obviously, neither the presence nor absence of commodity trade, nor the exogeneity or endogeneity of labour flows, distinguishes these approaches. We will comment briefly on each of these, but first dimensionality.

–**Figure 1 about here—**

In either case, we characterize production via a standard neoclassical production function:

$$y_j = f^j\left(\mathbf{z}_j\right),\qquad\qquad(1.9)$$

where j denotes a sector, and we drop it in the one sector case, z_j is a vector of inputs, and $f^j(\cdot)$ is a linear homogeneous, strictly quasi-concave function.[33] A convenient representation in either case is the unit-value isoquant–the locus of all input combinations that yield €1 worth of output (i.e., letting price be Pj, this is the $1/Pj$ isoquant). In figure 1 we suppose that $z' = \{S, L\}$, skilled and unskilled labour, denotes the economy's endowment, and the slope of the ray from the origin through z' identifies $s = S/L$ the equilibrium input ratio. From cost minimization and competitive markets we know that, in equilibrium, the slope of the isoquant will be equal to $\omega = -\,wu/ws$. Thus, an increase in the relative endowment of unskilled labour (from z' to z''), a fall in s, straightforwardly leads to a fall in ω.[34] Furthermore, if we suppose that the price of the final good is fixed, this translates to a real increase in the wage of

[32]In fact, neither approach diverges much from this assumption. This distinguishes the analysis of immigration from the analysis of the labour market effects of foreign direct investment and even trade.
[33]Where we need a general representation we will denote the set of all factors as I and its dimensionality as m, while the set of all goods is J with dimensionality n, i will index members of I *and* j will index members of J.

S and a real decrease in the wage of *L*.[35] The entire adjustment has occurred through a change in relative factor prices. As we saw in the previous section, this is the basis of the standard labour theoretic approach to determining the effect of immigration on a host economy. As we shall see in the next section, this setup provides a set of identifying assumptions that permits a very straightforward econometric analysis of the price (or, *mutatis mutandis*, employment) effects of increased immigration.

–Figure 2 about here–

Now suppose that we make only one change in the model, we add one more good and assume that good 1 is always *S*-intensive relative to good 2. Figure 2 labels denote the good from figure 1 "good 1" and the new good "good 2". Since both of the isoquants are unit-value isoquants, they must be tangent to a common €1 isocost line. As with the one good case, the tangent gives ω, common to both industries as a result of free inter-sectoral factor mobility, and identifies s_j (the technology in use in each sector)[36] By the small country assumption, the relative commodity price ($p = P_2/P_1$) is fixed, which fixes the unit-value isoquants, and thus fixes the common isocost, whose slope gives ω. The cone defined by the rays s_1 and s_2 is called the *cone of diversification* because any endowment in the interior of the cone involves production of both final goods at the given price, with the equilibrium technology in use. Thus, two economies, sharing the same technology sets and facing the same final good prices, but endowed with different proportions of *S* and *L*, will choose the same technologies (i.e. s_1 and s_2) and have the same ω. This is the Lerner (1952)-Samuelson (1948) *factor-price equalization theorem*. If we focus on a single country, this is easily seen as a very simple comparative static representation of immigration, with z' the initial endowment and z'' the

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[34]An alternative representation of this is that the value marginal product curve for unskilled labour is a downward sloping function of $1/s$. In the two factor case, with *S* and *P* (the price of final output) fixed, this is just the demand curve for unskilled labour.

[35] This follows from the standard weighted-average property of price changes (Jones, 1965):

$\hat{P} = \theta_L \hat{w}_L + \theta_S \hat{w}_S$, where the θ_I's denote distributive shares and the hats denote proportional changes. Thus, in figure 1, $\hat{w}_S > \hat{P} = 0 > \hat{w}_L$. It is also straightforward to show that the gain to domestic skilled labour exceeds the loss to domestic unskilled labour. With appropriate redistributive policy, citizens must gain. However, without such a policy it is easy to see that households deriving most of their income from unskilled labour would lose while skilled labour owning households would gain.

[36] Our assumption of no factor-intensity reversals guarantees that $s_1 > s_2$ for all ω.

endowment after an immigration shock consisting purely of unskilled labour.[37]   It is this version of the theorem that Leamer (1995) calls the *factor-price insensitivity theorem*.   The mechanism that brings this factor-price insensitivity about is the subject of the Rybczynski (1955) theorem. That is, with two goods, if commodity prices (and technology) are unchanged the location of the unit value isoquants cannot change, the equilibrium isocost cannot change, which means that the   ratio cannot change unless the economy specializes. Thus, the only way this economy can respond to a change in endowment, from z' to z'' (an increase in L with S fixed), is to change output mix, increasing output in the sector using L intensively (by proportionally more than the increase in L) and decreasing output in the other sector, as illustrated by the arrows. The essential point here is not that factor-price insensitivity actually obtains, but that, in a world with more than one output, some of the adjustment to an endowment shock will occur via a change in the output mix, reducing the actual, and measured, costs to the competing factor (i.e. domestic unskilled labour). In the Heckscher-Ohlin-Samuelson (HOS) model illustrated here, as long as both goods are produced, the only way to generate a change in relative factor-prices is to change the relative commodity prices.

From the point of view of thinking about presumption, it is important to note that factor-price insensitivity is quite robust to a variety of changes in assumptions which retain the essential properties of competitive markets and at least as many traded commodities as nontraded factors of production.[38] In particular, we can introduce non-traded goods, intermediates, and even joint production.[39]

One might expect that, and some discussions seem to suggest that, the fundamental difference between the labour theoretic and trade theoretic approaches to framing empirical research relates to the explicit incorporation of international trade flows. This, however, is not the case. As we have just seen, both the labour and trade theoretic approaches tend to hold the prices of final commodities exogenously fixed. As Altonji and Card (1991) point out, one

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[37]Interestingly, Samuelson concludes his original article of FPE with a discussion of its implications for immigration policy. Though the policy in question was that of encouraging emigration from England to Australia.

[38]On dimensionality generally see Jones and Scheinkman (1977) and Ethier (1984).

[39]Woodland (1984) contains exceptionally clear discussions of all these issues.

way to motivate this in the one good case is to suppose the domestically produced good is consumed and exported in exchange for an international good which is consumed, but not produced locally. Furthermore, the standard labour theoretic approach is to adopt a small country assumption that fixes the relative price of the exportable and the importable goods.[40] Trade economists are fond of the small, open economy model for the same reason: analysis of the supply side of the model can be abstracted from demand considerations.

When labour economists say that their model is a "closed economy" model, what they mean is that it is closed to immigration. That is, immigration will occur as a comparative static change in the endowment.[41] While a substantial trade theoretic literature has treated factor flows endogenously, there is no shortage of comparative static analysis.[42] Our illustration in figure 2 does precisely that, and one might reasonably argue that a small country, comparative static framework is the natural framework for empirical analysis on this question.[43] In any event, endogeneity of factor flows certainly does not distinguish between the labour and trade theoretic approaches.

Now we would like to argue for the plausibility of factor-price insensitivity as a presumption. We start by recalling that the sole relevant difference between the basic frameworks in use by labour and trade economists is dimensionality. First, dimensionality is not nearly so damaging of factor-price insensitivity as it is of factor-price equalization. The former is a one-economy comparative static result, while the second seeks to make a multi-country comparison, requiring both strong assumptions about internationally common technology and global univalence to make the comparisons. While Hanson and Slaughter's work suggests that technological change within a country may interfere with inference in

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[40]Altonji and Card, however, adopt a version of the large country assumption in their own framework.

[41]It should be noted that a sizable literature in labour economics is explicitly concerned with formally and econometrically modeling the migration decision, on the whole this literature is not particularly concerned with aggregate equilibria. Borjas (1994) and Lalonde and Topel (1997) survey much of this literature. For a survey that covers literature on migration decision-making in fields well beyond economics, as well as those in economics, see Massey, *et al*. (1998).

[42]Ruffin (1984) provides a very clear presentation of the trade theoretic literature on international factor mobility.

[43]Once we depart from the 1 sector labour theoretic framework or the 2 × 2 framework of the HOS model, trade and immigration may be related in a variety of ways which need to be considered in evaluating empirical results.

periods of large-scale technological change, the multi-good framework seems quite appropriate as the basis of but-for analyses of immigration shock. Second, contrary to some of the assertions by both trade and labour economists, it does not seem to us that the choice between $m \leq n$ and $m > n$, as interpretive frameworks, should rest on whether or not the framework generates income distribution effects from immigration.[44] Given the very weak evidence in favour such income distribution effects, this seems doubtful in any event. But it seems that, on any but fairly short-term interpretations of the concepts of commodity and factor, there are massively more commodities than factors, and in this case the *logic* of factor-price insensitivity holds quite straightforwardly.[45] Note that we are not arguing that factor-price insensitivity actually obtains, but that, within the parameters that are commonly agreed in the basic labour and trade theoretic traditions, $m \leq n$ seems a more plausible assumption, from which factor-price insensitivity follows. We should generally expect adjustment at the output-mix margin to play a considerable role in responding to factor immigration. If the mechanism breaks down, it must be as a result of deviations from those elements of the basic model that are shared between trade and labour economists, and not on dimensionality

So far we have argued, on essentially *a priori* grounds, that the trade theoretic framework dominates the labour theoretic framework as an intuition generator for evaluating the labour market effects of immigration. We would now like to finish this section by arguing that there is evidence in favour of the adjustment mechanism asserted in the trade theoretic account. An early contribution by Horiba and Kirkpatrick (1983) examined direct and indirect (i.e. trade embodied) flows of labour between the North and South United States in 1965-1970, finding that endowment convergence was relatively small, though in the right direction (i.e. labour and labour-intensive products are Southern exports), while the indirect labour flows were considerably larger and seemed to be doing most of the work in equalizing factor prices between regions. More recently, Horiba (2000) finds essentially the same results for 1975-1980. In particular, this work again finds that, migration and trade flows are consistent with

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[44]Trade economists like Thompson and Wooton seem to make this argument as the entering wedge of a political economy argument, while labour economists make the argument to shore up the foundations of their estimating framework.

[45]See Bernstein and Weinstein (1998) for a recent development of the dimensionality argument, and its implications for tests of directions of trade predictions.

the underlying trade model, the migration channel involves relatively small adjustment while the indirect trade in factors is considerably larger. These results are closely related to a growing body of trade research whose results suggest that the HO model, under various plausible extensions of the model (e.g. the presence of trading costs or Hicks neutral international differences in technology) and generalization of the Rybczynski theorem, does a reasonably good job of accounting for production patterns, and research on growth which fails to find a link between migration and convergence.[46]

Related to this work is a pair of papers by Hanson and Slaughter (2000) and Gandal, Hanson, and Slaughter (2000), the first dealing with the US the second with Israel. These are based on a clever accounting decomposition that seeks to identify the contributions of output-mix change and technological change in adjusting to endowment shocks. In the US case, Hanson and Slaughter (2000) present results consistent with productivity-adjusted factor-price equalization across states and, further, present evidence suggesting that states have absorbed changes in labour endowments primarily via skill-biased technological change which is common across all states and, secondarily, via changes in output mix. That there should be evidence of output-mix adjustment in a period of rapid and substantial technological change strikes us as important, especially considering Horiba's findings for a technologically less dynamic period. However, such evidence does not exist in the Israel case, where Gandal, Hanson, and Slaughter (2000) find that global changes in technology were (more than) sufficient to absorb the huge, relatively skilled influx of immigrants from Russia. In addition to the finding that output-mix adjustment was playing a role, there are two important implications of this work for the discussion to follow. First, there is some suggestion that, at least among relatively developed economies, the assumption of a common technology across countries may be less of a distortion that assuming a common technology across a finite period of time (at least during a technologically dynamic period). Second, while appropriately constructed comparative static analysis will identify important forces operating

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[46]On the subject of the endowment-output link, and the ways results vary in moving from inter-regional to international environments, see: Davis, Weinstein, Bradford, and Shimpo (1997); Davis and Weinstein (1997); Bernstein and Weinstein (1998); and Kim (1999). For the lack of a relationship between migration and convergence, see Barro and Sala-i-Martin (1991) and related work by Kim (1998) suggesting an important role for industrial structure, as well as technological change, in accounting for convergence.

at the level of the economy as a whole, dynamic forces that are not incorporated in the analysis might well overwhelm the static forces.[47] On the other hand, since these forces are both less well understood and less controllable, their relevance for policy analysis is very unclear.

IV. Conclusions

As we have stressed throughout this paper, the primary division in the literature on the labour market effects of immigration is not empirical. Unlike the related literature on the labour market effects of trade, where there are substantial differences over matters of fact, the impression one gets from the immigration literature is that there is a widely held, and fairly tight, prior on essentially zero labour market impact.[48] It is also widely agreed that there are sizable negative effects on migrants of the same origin and vintage, and, perhaps not quite so widely held, agreement that the small, and shrinking, group of native high school dropouts experience economically, and statistically, significant negative consequences from contemporary immigration.

To the extent that there is a dispute in the immigration case, it revolves around the framework to be used for evaluating the results of the empirical work, and here the division is very much between labour and trade economists.[49] We have argued that the sole substantive difference between labour and trade economists relates to the dimensionality of the model used to evaluate the results–with labour economists preferring an m-factor $\times$ 1-final good model and trade economists preferring an $m \times n$ good model (with a modal preference for the 2 $\times$ 2 model). As long as $m \geq 2$ and $n \geq 2$, output-mix adjustment will play a role in adjusting to an immigration shock, and the failure to account for that role will produce overestimates of the

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[47]In addition to technological change, we would also consider factor accumulation to be a dynamic force of considerable significance. It should probably be noted, as Hanson and Slaughter do, that capital accumulation may be playing a large role as well.

[48]People often talk about a loosely construed "average" opinion on the labour market effects of trade, but this represents a collective prior with very fat tails. The tails in the immigration case (e.g. Borjas, Briggs, Huddle) are visible and aggressive in asserting their opinion, but seem to have very small impact on the aggregate professional opinion.

[49] It is, in fact, quite striking in the trade and labour markets case, the extent to which heated disputes about interpretation take place between people who share a common model. As one example, see the papers by Leamer, Krugman, Deardorff, and Panagariya in the *Journal of International Economics* symposium (V.50-#1, pp. 17-116).

wage (or unemployment) effects of any given shock. Furthermore, we have also argued for the fundamental plausibility of the *m*-factor $\leq$ *n*-good model on essentially *a priori* grounds. If this argument is accepted, there is some presumption that output-mix adjustment fully absorbs the immigration shock. That is, if we are going to use a perfectly competitive baseline for policy evaluation, as revealed preferred by both labour and trade economists, our presumption should be that, immigration short of that necessary to generate a fundamental shift in production structure has no effect on long-run labour market conditions. Factor-price insensitivity holds.

As a presumption, from which to begin an evaluation of proposed immigration policy, or an evaluation of past immigration policies, this strikes us as the right presumption. And the fact that its key implication, essentially no labour market effect of immigration, is borne out by most empirical work, should strengthen our commitment to this presumption. But it is only a presumption–a point from which we should be willing to be shifted if faced with sufficient evidence in a given case. We have argued that factor-price insensitivity is surprisingly robust to plausible variations on the basic model, but the model is, itself, very simple. There are obviously many relevant facts of economic and social life that are not part of the model, but might well affect our ultimate evaluation of immigration policy. Perhaps the most significant of these relates to short-run adjustment cost. It is now well established that the economic short-run can be chronologically rather a long time, and that these adjustment costs can be substantial.[50] We only make two points here. First, these considerations are essentially orthogonal to immigration *per se*. That is, if we are concerned about adjustment costs borne by citizens, whether as a result of trade, immigration, technological change, or anything else, we have tools for dealing with them, and there is no particularly good reason for worrying about the source of worker dislocation. Second, this does not distinguish the labour and trade approaches. Within either framework, using immigration policy as an instrument for dealing with redistributive concerns is an exercise in (at least) second best.

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[50]That adjustment to a local labour shock may take a long time is one of the points that we take from the research on local labour markets that we have already mentioned, e.g.: Blanchard and Katz (1992); Decressin and Fatás (1995); and Topel (1986; 1994 a & b). On the economic effects of worker displacement, see: Topel (1991), Ruhm (1991), Kletzer (1991, 1996), and Jacobson, Lalonde, and Sullivan (1993).

This leads us to the most difficult question: if immigration is *really* not relevant to the long-run economic life of citizens, why does it occasionally become such a large political issue? In a companion paper to this one, we argue that the political economy of immigration policy cannot be understood as being about labour market effects and sketch an alternative account that embeds migration politics in a broader understanding of the politics of the welfare state and cultural adjustment to change.
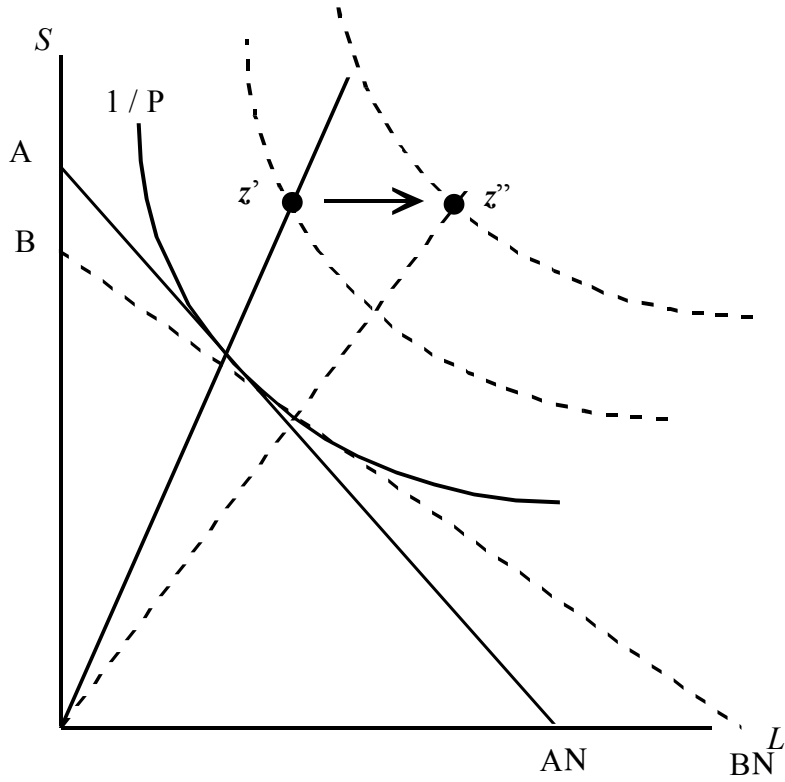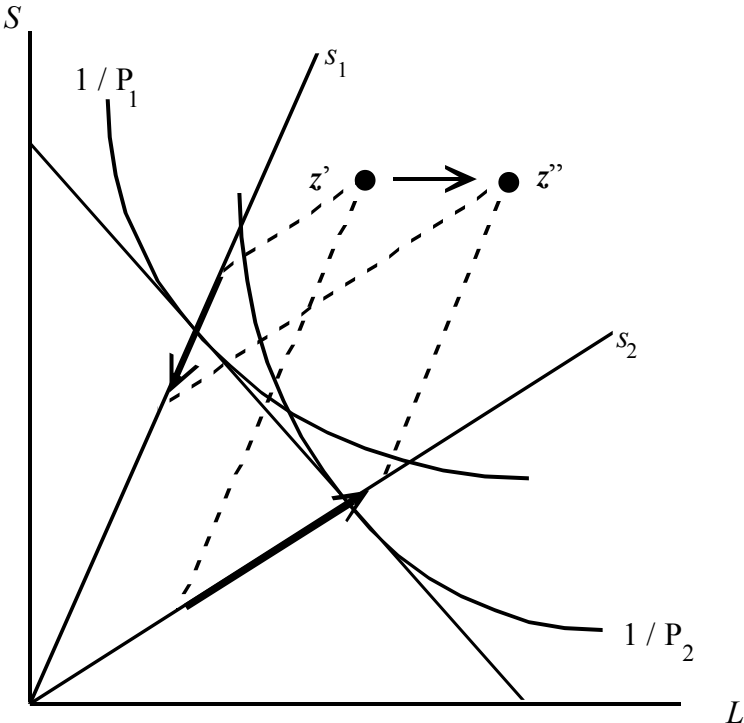
Figure 1

Figure 2

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