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Document de Travail
Working Paper
2014-12

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The Impact of Internal Migration on Local Labour Markets in Thailand

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February 2014

Abstract

We estimate the impact of internal migration on local labour markets in Thailand. Using an instrumental variable approach based on weather and distance we estimate an exogenous measure of the net migration inflow into each region. Our results show that instrumenting for the possible endogeneity of net inward migration is crucial to the analysis. The results suggest substantial adjustments in hours worked and weekly wages in response to short term changes in labour supply for low skilled males. We find no effect on high skilled workers. A theoretical section shows that a reduction in hours per worker in response to an increase in inward migration is consistent with the predictions of a standard search model.

JEL Classification: O15, J10

Key-words: Internal migration, Labour markets, Thailand

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1 Introduction

The 2009 Human development Report [UN (2009)] estimates that at least 740 million people worldwide are internal migrants, i.e., almost four times the number who have moved internationally. Despite this, perhaps because movements within borders often go undocumented, the literature on internal migration and its consequences on local labour markets is relatively small and not very well understood.[1] In this regard, a key difficulty in measuring the impact of internal migration is the endogeneity of migration. More precisely, net migration is expected to be correlated with economic conditions in each region making it difficult to identify the impact of migration on variables such as the wage and employment level, which also depend on these factors. In this study we use exogenous climatic shocks to identify the impact of internal migration on labour market outcomes in Thailand.

The literature on the impact of international migration on labour markets can serve as a first indication of what effects one might expect from internal migration. For example, well known studies such as Card (1991) looked at the impact of exogenous regional migration shocks such as the 1980 Mariel boatlift and found that migration had little impact on native wages. Critics argued that a possible cause for the absence of any observed effect of migration on natives is that natives might move to other local labour markets in response to an influx of migrants, thus masking the impact of migration on wages and employment. While some studies such as Aydemir and Borjas (2007) use national data to overcome this problem and find a negative effect of migration on wages, Aydemir and Borjas (2010) note that "...the national labour market approach may find itself with as many different types of results as the spatial correlation approach that it conceptually and empirically attempted to replace[2]." An alternative explanation for the absence of important effects on wages and employment prospects for natives from an increase in migration is that native and migrant workers may be imperfect substitutes [Manacorda, Manning and Wadsworth (2006), Ottaviano and Peri (2012), Peri (2011)]. In particular Manacorda *et al.* (2006) suggest using U.K. data that, while migrants and natives are imperfect substitutes, migrants are close substitutes for other migrants so that an increase in the stock of migrants lowers the wages of existing migrants but has little impact on natives. Arguably, however, internal migrants will be closer substitutes for native workers than international migrants

[1] Also see Lucas (1997) or Mendola (2012) for reviews of the literature on internal migration in developing countries.

[2] Some examples of studies that have examined this question with mixed results are Bonin (2005) who reports a very weak impact of supply shifts on wages in Germany. Bohn and Sanders (2007) find a weak wage effect on the Canadian labor market. Aydemir and Borjas (2007) use data from Canada and Mexico and find a strong negative relationship between wages and supply shifts induced by immigration while Mishra (2007) studies the Mexican labor market and finds a significant positive effect of emigration and wages in Mexico.

so that these effects are less likely to be as important for interprovincial migration within Thailand. Card (2009) concludes that for high school dropouts natives and migrants are perfect substitutes but natives and migrants are imperfect substitutes within higher skilled groups. This conclusion is consistent with the results we present below where we find labour market effects for low skilled workers only.

The little empirical literature that exists on the effect internal migration on local labour markets also presents mixed results. For instance, Beals *et al.* (1967) study the migration phenomenon in Ghana and show that income differentials drive migration and that regions of large population are relatively more attractive. Sahota (1968) finds that internal migration in Brazil is highly responsive to earning differentials and inversely related to distance. More generally, economic costs and returns dominate the behaviour of migrants. Phan and Coxhead (2010) analyse inter-provincial migration and inequality during Vietnam's transition. Their analysis suggests that the impact of migration on inequality can be either negative or positive. Boustan *et al.* (2010) study the effect of internal migration in the 1930s on the economic welfare of residents in US destination cities and find a small and not significant impact of in-migration on hourly and weekly earnings while Ham *et al.* (2011) use a distance based measure of migration to measure the effect of internal U.S. migration on wage growth and find that migration significantly increases wage growth for college graduates. Kennan and Walker (2011) show that expected income is an important determinant of interstate migration in the U.S.

In this paper we analyse the effects of inter-provincial migration on wages and employment in Thailand. Using the methodology developed by Boustan *et al.* (2010) we estimate the net inflow rate of migrants into each province thus controlling for the labour supply responses of natives to changes in migration. We take into consideration the geographic distance between sending and receiving provinces. In fact, the distance constitutes an important determinant of the location choice of one migrant and several studies consider that distance has a strong negative effect on migration.[3] Furthermore, we consider the fact that, in developing economies, weather conditions might induce a spatial reallocation of the relatively mobile input, labour.[4] Thus, local weather conditions can constitute a convenient and readily available instrument for migration rates (Boustan *et al.*, 2010).[5]

We use our framework and data from the Thai Labor Force Survey to identify the

[3] See, for instance, Sjaastad (1962), Sahota (1968) and Schwartz (1973).

[4] In this study, we consider voluntary climate-induced migration and not climate-forced migration.

[5] For instance, Yang and Choi (2007) examine how remittances sent by migrants respond to income shocks experienced by Philippine households. The authors use rainfall shocks as instrumental variables for income changes and show that, in households with migrant members, exogenous income declines are partially covered by foreign remittances. More particularly, households with migrant members enjoy a flat consumption path compared to households without migrants for whom consumption responds strongly to income shocks.

impact of internal migration on the weekly wage, hourly wage and on weekly hours worked for males at the destination markets in Thailand.[6] Arguably, Thailand constitutes an ideal case study for the task at hand. Standards of living, economic and cultural structures, and growth rates differ widely among provinces. As a consequence, levels and patterns of internal migration vary within the country. Also, Thailand is one of the earliest Southeast Asian economies to implement an export-led growth strategy, the consequence of which is an increase in rural-urban migration, especially to the service sector in Bangkok (Guest, 2003). Despite the 1997 crisis that altered migration patterns for seasonal and short-term workers, this long-term growth in labour migration has continued.[7] The internal migration of workers is induced by the wage differentials observed among provinces and modifies wages in receiving provinces. Moreover, migrants benefit from a net income increase that they share with household members in the form of money and goods they remit home. In this regard, Yang (2004) analyses the link between migration and cross-province inequality in Thailand and finds a significant effect of migration on income inequality. More particularly, she reports that a 1 percent increase in the mean fraction of out-migrants to Bangkok entails a 0.058 reduction in the average ratio of Bangkok's income to all other provinces.[8]

The empirical results we present below males indicate that inward migration has a substantial negative impact on the weekly wage of low skill natives, but this results from a reduction in weekly hours worked rather than in the hourly wage. In this regard, one might have expected an increase in migration to lead to higher hours worked and lower wages in a frictionless labour market. However, in our theoretical section we use the Mortensen-Pissarides (1994) search model modified to include hours worked by Pissarides (2000) to show that an increase in migration lowers the search costs associated with finding workers in equilibrium and leads to substitution from hours into workers in line with the empirical results.

The paper is organized as follows. In the next section we outline the theoretical model, section three outlines our data set. The fourth section presents the empirical specification and econometric results. The final section concludes.

[6]We focus on males because employment rates are much higher than for females and because for the latter estimation is further complicated by needing to model the labour supply decision.

[7]More particularly, the seasonal migration from the northeast of Thailand, facilitated by wide networks of friends and relatives, has continued on a large scale (IOM, 2008). This form of migration represents the main source of remittances for out-migration region.

[8]Vanwey (2003) analyses the role of land ownership in rural temporary migration in Thailand.

2 Theory

Kinoshita (1987) derives the equilibrium properties in the standard competitive model where firms combine hours per worker with the number of workers in the production function.[9] We begin by sketching how an increase in migration might affect equilibrium in this type of model and continue by outlining how the results might differ when there are search frictions in the model.

In general the equilibrium hours per worker hourly wage locus is a set of tangencies where workers who wish to work longer hours match up with like-minded firms. In equilibrium the supply and demand of each worker type are equal and no worker or firm can gain from deviating to another point on the locus. Compensating wage differentials are paid to workers for working a less desirable number of hours.[10] Firms are assumed to be able to hire as many workers as they wish at any level of hours (h). If there is only one type of worker and firm, the workers' indifference curve is the equilibrium hours wage locus and the firms' isoprofit curve over hourly wage and hours per worker space.[11] Figure 2 illustrates a tangency between the indifference curve of a representative worker and the isoprofit curve of a firm if preferences and the firm's technology are well behaved. We expect that an increase in migration (Labour supply) would shift the equilibrium indifference curve downward and as long as equilibrium is on an upward sloping part of the indifference curve (so that in equilibrium a firm would pay a higher hourly wage if they wished to induce workers to work longer hours) a lower reservation indifference curve will be tangent to the isoprofit curve at higher hours per worker and a lower hourly wage. Even in this simplest version of the competitive model with a representative worker and firm it is theoretically possible that the equilibrium is on a downward sloping part of the indifference curve where workers work short hours and would accept a lower hourly wage to work longer hours and where an increase in labour supply (downward shift in the indifference curve) would lead to lower hours per worker, although arguably most labour economists might expect there to be a positive relationship between hours and the hourly wage for most workers in equilibrium. That is our expectation from the standard model might be that an increase in migration, where migrants are substitutes for natives, would increase labour supply and lead to lower wages and longer working hours.

Another prediction of standard models of the labour market is that an increase in the fixed costs of hiring workers can cause firms to substitute from workers into longer hours per worker [See Hamermesh (1993) Chapter 7 for example]. Most of the modern labour

[9] The following passage draws heavily on the introduction to Strobl and Walsh (2011).

[10] The models of Lewis (1969) and Rosen (1986) are the precursors to this model.

[11] The firm chooses the number of workers optimally and we substitute the first order condition on the number of workers into the profit function to trace out the isoprofit curve.

labour literature models labour market flows in a framework where there are search costs associated with firms and workers meeting. In the model presented here we use one of the most common search models: the Mortensen-Pissarides (1994) search model with hours worked included, as outlined in Pissarides (2000) and analyse the impact of migration on hours and wages. The intuition is that migration may lower the time and cost of contacting workers and lead to substitution from hours into workers so that hours per worker falls in contrast to the expected prediction from the competitive model outlined above.

Below we present the search model outlined in Pissarides (2000) section 7.3. We incorporate a fixed benefit payment to unemployed workers into the model and analyse the impact of an increase in migration (an increase in the labour force) on hours and the number of workers in equilibrium. We show that an increase in migration is associated with a decrease in labour market tightness so that it takes less time for firms to find workers. This increases the employment rate in a stationary equilibrium and reduces the number of hours per worker.

There is a matching function which is homogeneous of degree one so that the number of matches taking place at each unit of time is:

$$mL = m(uL, vL) \tag{1}$$

The labour force is L, the unemployment rate is u and the number of vacancies as a fraction of the labour force is v. We define the ratio of unemployment to vacancies (labour market tightness as): $\theta = \frac{v}{u}$. The rate at which vacant jobs are filled can be rewritten:

$$q(\theta) = m\left(\frac{u}{v}, 1\right) \tag{2}$$

The mean duration of a vacancy is: $\frac{1}{q(\theta)}$ and the percent change in $q(\theta)$ from a percent change in θ is $-1 \leq \eta < 0$. Similarly the rate at which unemployed workers find jobs is:

$$\theta q(\theta) = \frac{m\,(uL, vL)}{uL} \tag{3}$$

The mean duration of unemployment is: $\frac{1}{\theta q(\theta)}$ and the elasticity is $1 - \eta$. Idiosyncratic shocks destroy jobs at a rate λ. With a fixed labour force the number of workers who enter unemployment during a short interval δt is:

$$\lambda(1 - u)L\delta t \tag{4}$$

The mean number of workers who leave unemployment at each point in time is:

$$mL\delta t = u\theta q(\theta)L\delta t \tag{5}$$

The unemployment rate in the steady state is:

$$u = \frac{\lambda}{\lambda + \theta q(\theta)} \tag{6}$$

It also follows that if the labour force is L then aggregate employment is:

$$N = (1-u)L = \frac{\theta q(\theta)L}{\lambda + \theta q(\theta)} \tag{7}$$

Equation (6) is the Beveridge curve which can be used to graph the relationship between the vacancy rate and unemployment rate in long run equilibrium. This is independent of the size of the labour force. The workers instantaneous utility depends on current income and current hours of work. Instantaneous utility during employment is:[12]

$$w_E = wh\phi(1-h) \qquad \phi'(.) > 0, \phi''(.) \leq 0, 0 \leq h \leq 1 \tag{8}$$

where the hourly wage is w, the length of the day is normalised to unity and the utility function is linear in wage income and non-linear in the disutility of work. We continue by assuming the Cobb-Douglas utility function for hours:

$$\phi(1-h) = (1-h)^{\alpha} \qquad \text{where} \qquad 0 < \alpha < 1 \tag{9}$$

The flow utility from unemployment and employment are:

$$rU = z + \theta q(\theta)(W - U) \tag{10}$$

The model differs from the model in Pissarides (2000) in that we include a fixed payment z to unemployed workers. Pissarides (2000) discusses the possibility of making this payment proportional to the wage and we might reasonably argue that benefits are a function of earnings in many countries. While this is reasonable in terms of analysing long run equilibrium, we suggest here that if we wish to analyse the short run effects of migration we do not expect benefits to respond instantaneously to any change in wage associated with short run migration flows. This is important for the results in that if benefits are fixed the wage will not be fully proportional to productivity. Because wages are not proportional to

[12] We note that $\phi'(.)$ is the marginal utility of leisure which is positive. In the analysis we will differentiate with respect to work hours where $\frac{\delta\phi(1-h)}{\delta(h)} = -\phi'(1-h)$.

productivity there will be a relationship between the equilibrium level of productivity and labour market tightness. This means that if an increase in migration affects employment and the equilibrium level of productivity, this will also lead to an effect on labour market tightness and search costs. We will see that this leads to a change in hours per worker.

$$rW = wh\phi(1-h) + \lambda(U-W) \tag{11}$$

Wages and hours are chosen by Nash bargaining where the flow value of a vacancy is:

$$rV = -p[Nh]c + q(\theta)(J-V) \tag{12}$$

The cost of maintaining a vacancy per unit of time is pc while there is a probability of that the vacancy will be filled. We assume that productivity is the constant p[Nh] but that the productivity of additional matches is diminishing at the aggregate level, so that the change in productivity from a change in aggregate hours worked NH is negative. The flow value of a filled job is:

$$rJ = p[Nh]h - hw - \lambda J \tag{13}$$

Hours and the wage are chosen to maximise:

$$(W-U)^{\beta}(J_j - V)^{1-\beta} = \left(\frac{wh\phi(1-h_j - rU}{(r+\lambda}\right)^{\beta}\left(\frac{[p(N,h)-w]h}{r+\lambda} - V\right)^{1-\beta} \tag{14}$$

where $0 < \beta < 1$.

We note that when the worker and firm engage in bargaining at the level of the individual worker/job match, the value of the outside option is exogenously given to the worker as is the value of a vacancy to the firm.

Proposition 1 *An increase in the labour force (inward migration) leads to a decrease in labour market tightness and lower hours per worker.*

Proof. in the Appendix. ■

3 Data and Sample Selection

We use data on males from the Thai Labour Force Survey between 1991 and 2000. The survey is conducted several times a year and with increasing frequency in recent years. We have data for the February and August surveys for each year. The survey is a large cross-section; for example, the February 2000 survey has 164,636 observations. In sum, the complete data is constituted of twenty waves with a total of 2,951,839 observations.

August is the peak of the agricultural season and labour markets are much more buoyant with significant internal migration as workers return to rural areas for harvesting. February clearly represents the off-peak season in Thailand.

The survey contains a wide variety of questions on location, employment status and job characteristics, income as well as demographic characteristics. Data on earnings asks workers if they are paid hourly, daily, weekly, or monthly and what the rate of pay is for the relevant category. Summary statistics for the total sample shows that 91% of workers are paid either daily or monthly, where most waged workers at the low skill end of the labour market are paid daily. There are seventy two provinces in Thailand as shown in Figure 2. In addition to providing the name of the province where they live, individuals answer the following question: "How long have you been living regularly in this village/ municipality?" Respondents can answer from less than a year, one year, two years, up until nine or more than nine years. We exclude people who move into the same province and calculate the number of recent arrivals as those who answer less than or equal to one year. This number corresponds to 124,185 individuals and represents 52.4% of total movers to new provinces.[13] We use this subsample of movers to compute the inflow and outflow rates. Then we define the province of origin and the destination province of all movers as people are asked "Which is the previous province of your residence before moving here?". The survey then asks for the reason of migration. Among recently moved people, some 35.71% were looking for a job or occupation. However, 7.62% of respondents migrate for further study, 22.75% follow their family and 28.53% report coming back to their former residence. Only 0.22% of migrants state moving from one province to another in order to be nursed. Concerning the province of destination, Bangkok counts the largest proportion of arrivals with 7.2% of total recent migrants.[14] We construct a sample of non-migrants residing in different areas - municipal, non-municipal, sanitation district - in the 72 Thai provinces. We consider as incumbents all recent migrants who moved within the same province and we reduce our sample to the working age population.

As for the empirical analysis, we reduce the sample to men aged 15-64 who were not attending school at the moment of the survey and who work 95 hours or less a week in the private sector. We drop observations of self-employed, government or public service workers as well as workers who are in unpaid jobs. After controlling for missing values, the sample used in all the wage and hours regressions below is constituted of 216,282 observations where incumbents account for 194,410 observations and recent migrants represent more than 10% of the sample. According to their skill group, we observe that high-skilled

[13]Note that the category of movers within provinces represents 29% of all movers and that 49.4% of the sample of movers from this category moved one year ago at most.

[14]The second best destination province is Udon Thani with 4.26% of total recent migrants.

workers account for 64,361 observations of the subsample of incumbents and for 7,869 observations of the subsample of recent migrants.[15]

Table A1 in the appendix provides summary statistics separately for the subsamples of incumbents and recent migrants for whom all the variables are non-missing. The statistics show that 99% of the salaries are paid on a daily or monthly basis. The weekly wage is about 1021.2 bahts for recent migrants and 1151.7 bahts on average for incumbents. Moreover, recent migrants are younger on average, work more hours per week than incumbents and are more likely to be single. The firm size statistics show that recent migrants are more likely to be employed in larger firms. While 25% of incumbents work in firms with 50 employees and more, 35% of recent migrants are observed in large firms. More distinctions by occupation and industry are observed.

4 Econometric Analysis

4.1 Construction of Instruments

In order to construct instruments for migration we follow the methodology proposed by Boustan *et al.* (2010), which consists of predicting the total outflow (inflow) from a region induced by weather shocks, and then decomposing this outflow (inflow) into destination regions by estimating the role of geographic distances in determining inter regional flows. We then use both weather and distance to construct the predicted inflow (outflow). More specifically, for the case of migration inflow this first involves regressing total outflow rates of each region on a set of climate determinants:

$$O - rate_{i,t-1 \to t} = \alpha + \delta' Z_{i,t-1} + \epsilon_{i,t} \tag{15}$$

where $O - rate_{i,t-1 \to t}$ is the outflow rate from source region i over time period $t-1$ to t, Z is a vector of climate specific indicators, and ϵ is an error term. Using the estimated coefficients from (1) the predicted flow of migrants leaving each region i, $\tilde{O}_{i,t-1 \to t}$ is then just equal to the predicted outflow rate, $\bar{O} - rate_{i,t-1 \to t}$, times the population at $t-1$:

$$\tilde{O}_{i,t-1 \to t} = \bar{O} - rate_{i,t-1 \to t} * Population_{i,t-1} \tag{16}$$

One then separately for each sending area i regresses the actual set of destination specific outflow rates to each destination region j on their relative distances and it's squared

[15] High-skilled persons are limited to those with an educational level beyond the secondary level.

and cubic value[16]:

$$O - rate_{ij,t-1\to t} = \alpha_i + \theta_i Distance_{ij} + \theta_i Distance_{ij}^2 + \theta_i Distance_{ij}^3 + \mu_{it} \quad (17)$$

The instrument for in-migration to region j, $\bar{\bar{I}}_(j, t-1 \to t)$, is then just the sum of the predicted number of migrants over all areas $(i \neq j)$, $\bar{O} - rate_{ij,t-1\to t}$ expected to settle in region j:

$$\bar{\bar{I}}_(j, t-1 \to t) = \sum_{i=1,\dots,n(i\neq j)} \tilde{O}_{i,t-1\to t} * O - rate_{ij,t-1\to t} \quad (18)$$

One can then in a similar manner construct predicted outflow from area j by predicting the in-migration rates to each receiving area i using climatic determinants, using these rates to predict the number of inflowing migrants into i, and then constructed predicted outflow migrants by multiplying this figure by the from distance and its non-linear terms estimated inflowing rates between regions i and j $(i \neq j)$.

In order to estimate (15), as well as its analogous specifications for the in-migration, we use for the vector Z a number of measures that capture weather conditions in a region. In order to identify periods of extreme wetness and dryness in regions we first calculated the local standardized precipitation index (SPI), which has been argued to be particularly good at capturing the cumulative effect of high and low patterns of rainfall over time in a chosen locality, from the mean monthly precipitation values within our regions as calculated from the IPCC data set.[17] Following McKee *et al.* (1993) we then define a monthly extremely dry (wet) event as starting when the SPI reaches an intensity of -2.0 (2.0) or less (more) and as ending once the index become positive (negative) again. For each time period we then calculate the number of months of extreme dryness (wetness). To capture the effect of temperature, in particular with respect to its importance for agriculture, we construct a measure of reference evapotranspiration (ET) to represent the evaporative demand of the air within a basin. Following Hargreaves and Samani (1985), evapotranspiration is calculated as:

$$ET = 0.0023(T_{avg} + 17.8)(T_{max} - T_{min})0.5Ra \quad (19)$$

where T_{avg}, T_{max} and T_{min} are mean, maximum and minimum temperature, respectively

[16] One should note that Boustan *et al.* (2010) regress these rates only on distance and its squared value. For the case of Thailand we found that including its cubic value substantially increased the specifications fit.

[17] The calculation of the SPI is based on modeling the probability distribution of precipitation as derived from long term records by fitting these to a gamma distribution via maximum likelihood. An important component in this regard is the chosen time scale. Since we are interested in cropland productivity and soil moisture conditions are known to respond to precipitation anomalies over a relatively short time period, we use a 12 month scale. See http://www.drought.unl.edu/whatis/indices.htm.

and Ra is the extraterrestrial radiation calculated following Allen *et al.* (1998). Since the effects of rainfall shortages and abundance on local agricultural are likely to some extent to depend on the local evaporative demand, we also allow for interactions between ET and WET and DRY. To construct all these climatic factors at the regional level we resort to information from the Inter-Governmental Panel on Climate Change (IPCC) climatic data set, which provides monthly precipitation and temperature measures across the globe at the 0.5 degree level over the entire 20^{th} century. This is used to calculate out regional averages of the inputs.

The results of estimating (15) for the annual regional out- and in-migration rates, controlling for regional specific fixed effects and region common time specific factors are given in Table 1a. Moreover, we calculate Driscoll and Kray (1998) standard errors corrected for spatial correlation throughout. As can be seen, for both of inflow and outflow rates, the set of climatic variables are almost all significant, producing highly significant F-tests of joint significance. Examining the individual factors, one finds that for the precipitation related factors the signs meet a priori expectations. More specifically, one finds that extremely dry as well as extremely wet weather, indicative of drought and flood like conditions, respectively, act to increase overall outflow from regions. Moreover, the negative impact of rainfall shortage is further exacerbated by a high evapotranspirative demand of the air. Somewhat surprisingly, the direct effect of evapotranspiration is to reduce outflow from a region, although in absolute terms this impact is small. For the inflow rate, one finds that extremely wet periods tend to reduce the inflow rate, while droughts have no significant effect. Furthermore, a high evapotranspirative demand of the air tends to reduce the effect of the latter. Somewhat peculiarly one finds that this demand on its own acts to increase person flowing to the region, although again not substantially so. To construct the predicted inward and outward migration rates by sub-group we proceeded in similar manner as for the overall sample, except restricting construction via (15) through (18) to the sub-sample in question. We report the estimation for (15) for the outflow and inflow rates in Tables 1b and 1c, respectively. As can be seen, for the outflow rate all climatic variables are significant, where the signs are in congruence with the overall sample. Unsurprisingly the joint F-tests attests to their power as predictive factors. For the inflow rates, the majority of coefficients are significant and similar to those from the overall sample. Similarly, the F-test statistics provides evidence of their predictive power.

In terms of estimating (17), since this involves estimating different specifications for each region, we only provide a brief outline of the results. One may want to first note that since our distance measures do not vary over time, our estimated specification in (17) does not control for region specific effects, but does include a set of time dummies to control for common region time specific factors determining the migration flows. We used Driscoll and Kray (1998) standard errors corrected for spatial correlation as we did for (15). For each region specific regression, we, after estimating the parameters on distance conducted an F-test of the null hypothesis that these were jointly zero. In the case of out-migration rates for only 4 regions, while in the case of in-migration rates for only 6 could the null hypothesis not be rejected. As with the overall sample the F-test of the distance variables suggested strong predictive power in almost all cases for the estimation of (17) for subgroups.

In Table 2 we depict the results from the first stage regression where we use predicted migration rates constructed as outlined above to predict actual net migration rates. Table 2 shows the results for men by skill. As can be seen, and is indicated by the F-Test on the instruments, the predicted inflow rate variables significantly predict an increase in actual net migration, whereas predicted out-migration rate acts to decrease net migration. Using bootstrapped standard errors and the corresponding Wald tests show similar results although standard errors are somewhat larger.

4.2 The Effect of Net Migration on the Local Labour Market

We next examine the impact of net inward migration on the weekly wage, weekly hours and hourly wage for males of working age (15-64 controlling for individual characteristics). In particular when we look at the impact of migration on the wage we control for age and age squared, marital status (four dummies indicating single, married, widowed or divorced status), a set of twelve educational indicator dummies, ten occupation dummies and ten industry dummies, seven firm size dummies, dummies indicating whether the worker is paid hourly, daily, weekly or monthly and a dummy indicating whether the worker lives in a municipal area. We also include average age and the fraction of workers with no education at the province level as well as province and time specific effects. The results on the estimated coefficient on the net inward migration rate for weekly wage and weekly hours and the hourly wage are reported in Table 3. So for example the coefficient of -.088 on weekly wages in the OLS results in Table 3 indicates that an increase in the net migration rate of 10% (which means the working age population increases by 10% due to net migration) is associated with a decrease in male wages by 8.8%. A clear worry here is that, as noted earlier, we might expect migration inflows to depend on local economic conditions which also affect the wage level or level of hours worked. The results from the instrumental variables regression confirm that this worry is legitimate, showing a weekly wage decrease of 31.5% for males when migration increases population by 10%. We also note that while OLS results indicate a small insignificant coefficient on hours worked the instrumental variables results indicate that a 10% increase in population by migrants lowers weekly hours by 11.753, i.e., a decrease of about 22% based on the summary statistics.

Table 3 provides results by high and low skill group. This makes a substantial difference to the OLS results. Skill specific migration is negatively associated with weekly wages for high skilled workers with a 8.6% fall in wages for a 10% increase in population. Low skill weekly wages fall by 5.3% for a similar increase in migration.[18] Coefficients on weekly hours are small and statistically insignificant for both skill groups. Once again instrumenting makes a substantial difference to the results. For the instrumental variables analysis weekly wages of skilled workers are unaffected by migration while unskilled weekly wages fall by 53.4% in response to a 10% increase in the population. The coefficient on hourly wage is statistically insignificant while hours worked fall by 18.839 if population increases by 10%. This represents a decrease of 36% in the average hours of low skilled incumbents.

5 Conclusion

In this paper we have examined the impact of net inward migration on local labour markets in Thailand. To this end we have constructed a data set of regional migration flows and individual labour market outcomes for the period 1991 to 2000 using the Thai Labour Force Survey. Our results show that instrumenting for the possible endogeneity of net inward migration is crucial to the analysis. The results suggest that wages of low skill male workers are highly flexible with substantial adjustments in hours worked and weekly wages in response to short term changes in labour supply. We find no effect on high skilled workers. It may be that wages are slower to adjust for skilled workers due to implicit contracts, firm specific capital or other institutional features that limit firms' ability or willingness to adjust wages in response to possibly temporary shock.[19] Another possibility is that if there is a degree of imperfect substitutability between natives and migrants that this is only the case amongst higher skill groups as Card (2009) suggests.

While there is a large literature estimating the impact of migration on wages, typically such studies do not consider variations in hours per period. The empirical results presented here suggest that this may be an important omission. For example if we restricted our analysis to hourly wages the empirical results would suggest that migration does not affect wages while in fact there are substantial changes in weekly earnings associated with hours.

[18] We explored the possibility that low/high skill worker's wages and hours might be affected by the migration rate of the other group: that is that to explore whether these groups were complements/substitutes for one another. Unfortunately migration rates for are highly correlated across groups (even when instrumented) making it difficult to identify a separate effect.

[19] See Beaudry and Dinardo (1991) for an example and some evidence for an implicit contracts model while Hall (2005) shows that the local monopoly rents in a search matching model mean that wages can be sticky without violating rationality.

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Figure 1: Thai Provinces

Figure 2: Indifference and Isoprofit Curves

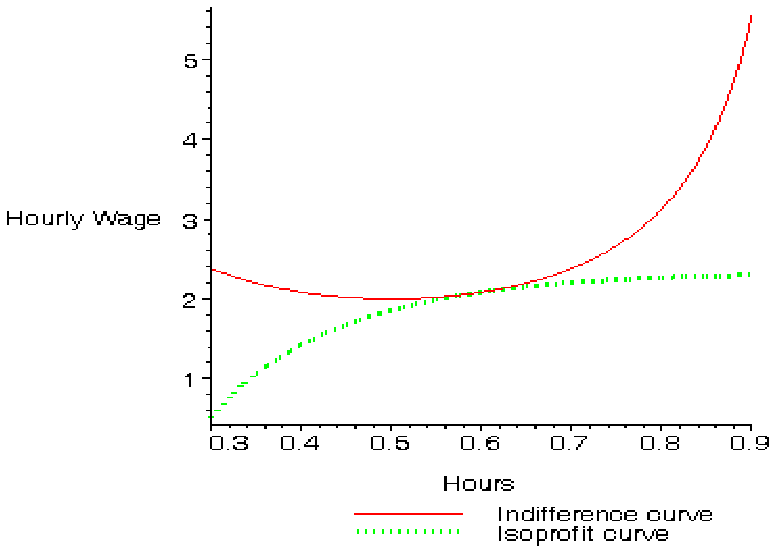

Table 1a: The Effect of Weather on Migrant Flows

	Outrate	***Inrate***
Dry	0.00266*	-2.45e-05
	(0.00130)	(0.000964)
Wet	0.00352*	-0.00358**
	(0.00135)	(0.000701)
EVAPO	-0.000222*	0.000710**
	(8.90e-05)	(0.000192)
EVAPO*Wet	3.04e-05	-5.95e-05**
	(1.55e-05)	(1.16e-05)
EVAPO*Dry	3.36e-05*	-1.34e-05
	(1.56e-05)	(6.74e-06)
Observations	1,440	1,440
Number of groups	72	72
F-Test	4.963	8.616

Notes: (i) Driscoll and Kray (1998) standard errors corrected for spatial and autocorrelation in parentheses; (ii) ** and * are 1 and 5 per cent significance levels; (iii) Standard errors are in parentheses; (iv) Year and binannual dummies included but not reported; (v) F-test is test of joint significance of the climatic variables.

Table 1b: The Effect of Weather on Outflow Rates

	(1)	*(2)*	*(3)*
Dry	0.00142*	0.00166*	0.00120
	(0.000625)	(0.000648)	(0.000618)
Wet	0.00235**	0.00231**	0.00238**
	(0.000709)	(0.000692)	(0.000736)
EVAPO	-0.000227**	-0.000262**	-0.000197**
	(7.61e-05)	(8.85e-05)	(6.81e-05)
EVAPO*Wet	2.75e-05**	2.54e-05**	2.95e-05**
	(7.25e-06)	(7.64e-06)	(7.35e-06)
EVAPO*Dry	1.88e-05*	2.14e-05*	1.65e-05*
	(7.68e-06)	(9.34e-06)	(6.40e-06)
Sample	Men	Low-skilled Men	High-skilled Men
Observations	1,440	1,440	1,440
Number of groups	72	72	72
F-Test	9.028	8.172	9.926

Notes: (i) Driscoll and Kray (1998) standard errors corrected for spatial and autocorrelation in parentheses; (ii) ** and * are 1 and 5 per cent significance levels; (iii) Standard errors are in parentheses; (iv) Year and binannual dummies included but not reported; (v) F-test is test of joint significance of the climatic variables.

Table 1c: The Effect of Weather on Inflow Rates

	(1)	*(2)*	*(3)*
Dry	-0.000417**	-0.000562**	-0.000375**
	(0.000153)	(0.000129)	(0.000129)
Wet	-0.000891*	-0.000797*	-0.000764**
	(0.000366)	(0.000325)	(0.000266)
EVAPO	0.000636**	0.000613**	0.000439**
	(0.000182)	(0.000163)	(0.000160)
EVAPO*Wet	-8.68e-06	-5.18e-06	-9.63e-06
	(6.42e-06)	(5.34e-06)	(4.97e-06)
EVAPO*Dry	-9.25e-06	-9.87e-06	-9.74e-06
	(1.10e-05)	(7.63e-06)	(6.74e-06)
Sample	Men	Low-skilled Men	High-skilled Men
Observations	1,440	1,440	1,440
Number of groups	72	72	72
F-Test	18.15	31.16	8.963

Notes: (i) Driscoll and Kray (1998) standard errors corrected for spatial and autocorrelation in parentheses; (ii) ** and * are 1 and 5 per cent significance levels; (iii) Standard errors are in parentheses; (iv) Year and binannual dummies included but not reported; (v) F-test is test of joint significance of the climatic variables.

Table 2: Relationship between Predicted and Actual Migration for Men

	Total Sample	***Low-skilled Subsample***	***High-skilled Subsample***
WLS Regression			
Predicted in-migration rate	5.332	3.007	3.262
	(2.592)	(1.300)	(1.387)
Predicted out-migration rate	-9.537	-4.101	-5.539
	(3.302)	(1.128)	(1.219)
F-Statistic	15.1	16.1	12.4
Bootstrapped Procedure			
Predicted in-migration rate	5.576	3.103	3.491
	(3.088)	(1.424)	(1.549)
Predicted out-migration rate	-9.591	-4.168	-5.490
	(2.756)	(1.243)	(1.398)
Wald's Statistic	2057	1704	3535

Notes: (i) Regressions are estimated using individual data from the Thai LFS from 1991 to 2000; (ii) Standard errors are clustered by provinces and waves; (iii) Dummies for salaries period of payment (hourly, daily, weekly and monthly) are introduced. (iv) For wage regressions, we introduce the number of weekly working hours and its squared term; (v) We include both the high-skilled and low-skilled net instrumented migration rate for each of the six subsamples shown above; (vi) ***, ** and * denote significance at the level of 1%, 5% and 10% significance levels, respectively.

Table 3: Effect of Net Migration on Work Time, Weekly and Hourly Wages
- Sample of Incumbent Working Men in the Private Sector -

	Total Sample	***Low-skilled Subsample***	***High-skilled Subsample***
Ordinary Least Squares			
ln(weekly wage)	-0.088***	-0.053*	-0.086**
	(0.030)	(0.031)	(0.034)
ln(hourly wage)	-0.105**	-0.073*	-0.124**
	(0.042)	(0.042)	(0.057)
hours worked	0.610	0.697	1.445
	(2.086)	(2.447)	(2.260)
Instrumental Variable			
ln(weekly wage)	-0.315***	-0.534**	-0.168
	(0.118)	(0.222)	(0.123)
ln(hourly wage)	-0.171	-0.334	-0.153
	(0.129)	(0.210)	(0.144)
hours worked	-11.753***	-18.839**	-0.817
	(5.449)	(8.962)	(4.057)
Observations	194,410	130,049	64,361

(i) Regressions are estimated using individual data from the Thai LFS from 1991 to 2000; (ii) Standard errors are clustered by provinces and waves; (iii) Dummies for salaries period of payment (hourly, daily, weekly and monthly) are introduced. (iv) For weekly wage regressions, we introduce the number of weekly working hours and its squared term; (v) With the instrumental variable technique, we include the net instrumented migration rate specific for each subsample; (vi) ***, ** and * denote significance at 1%, 5% and 10% significance levels, respectively.

Table 4: Mean and Standard Deviation migration rates
- Subsamples of High-skilled/Low-skilled Men -

	Mean	***Standard Deviation***
Men	0.00094	0.06631
Low Skilled Men	0.00182	0.05775
High Skilled Men	-0.00590	0.06958

APPENDIX: Proof of Proposition One

The first order conditions for the wage and hours of work satisfy:

$$\beta(J-V)\frac{\delta(W-U)}{\delta w}+(1-\beta)\frac{\delta(J-V)}{\delta w}=\beta(J-V)\phi(1-h)-(1-\beta)(W-U)=0 \quad \text{(A.1)}$$

and

$$\beta(J-V)w\phi(1-h)\left[1-\frac{\phi'(1-h)h}{\phi(1-h)}\right]=-(1-\beta)(W-U)[p(N,h)-w] \quad \text{(A.2)}$$

Firms continue to create vacancies until the marginal product of an additional vacancy is zero so that:

$$J=\frac{pc}{q(\theta)} \quad \text{(A.3)}$$

From (9) and (10) we calculate:

$$W-U=\frac{wh\phi(1-h)-z}{r+\lambda+\theta q(\theta)} \quad \text{(A.4)}$$

Substituting (A.4) in (11) we get:

$$[p(Nh)-w]\,h=\frac{r+\lambda}{q(\theta)}pc \quad \text{(A.5)}$$

Hence by using V=0, the value of J from A(3), the value of $W-U$ from (A.4) and using $\frac{[p(Nh)-w]hq(\theta)}{pc}=r+\lambda$ from (A.5) (18), we get the wage equation from the first order condition on the wage [equation (A.1)] as:

$$w=\beta p(N,h)\left[1+\frac{\theta c}{h}\right]+(1-\beta)\frac{z}{h\phi(1-h)} \quad \text{(A.6)}$$

Using the value for $\beta(J_j-V)\phi(1-h)$ from (A.1) in (A.2) we see that h is chosen such that:

$$w=p(E)\frac{\phi(.)}{\phi'(.)h} \quad \text{(A.7)}$$

The job creation equation is (A.5) and can be rewritten in terms of the hourly wage as:

$$w=p(E)\left[\frac{q(\theta)h-(r+\lambda)c}{q(\theta)h}\right] \quad \text{(A.8)}$$

Equation (A.7) can be rewritten for the Cobb-Douglas utility function [equation (9)] as:

$$w=p(E)\frac{\phi(.)}{\phi'(.)h}=\frac{p(E)}{\alpha}\frac{1-h}{h} \quad \text{(A.9)}$$

Equating equations (A.7) and (A.9) we can solve for hours as:

$$h = \frac{1}{1+\alpha} + \frac{\alpha}{(1+\alpha)} \frac{(r+\lambda)c}{q(\theta)} = \frac{1}{1+\alpha} \left[\frac{q(\theta) + \alpha(r+\lambda)c}{q(\theta)} \right] \tag{A.10}$$

We note that since $q'(\theta) < 0$:

$$\frac{\delta h}{\delta \theta} = -\frac{\alpha}{(1+\alpha)} \frac{(r+\lambda)cq'(\theta)}{q(\theta)^2} > 0 \tag{A.11}$$

Hours per worker increases with labour market tightness. The implication of this is that if an increase in migration leads to a fall in labour market tightness, hours per worker will fall. We also note that:

$$1 - h = \frac{\alpha}{(1+\alpha)} \left[\frac{q(\theta) - (r+\lambda)c}{q(\theta)} \right] \tag{A.12}$$

Using equation (7) for the aggregate number of workers and equation (A.10) for hours per worker we get:

$$Nh = \frac{\theta L}{\lambda + \theta q(\theta)} \left[\frac{q(\theta)}{(1+\alpha)} + \frac{\alpha(r+\lambda)c}{(1+\alpha)} \right] \tag{A.13}$$

We note from equation (7) that:

$$\frac{\delta N}{\delta \theta} = \lambda q(\theta) \frac{1 + \theta \frac{q'(\theta)}{q(\theta)}}{[\lambda + \theta q(\theta)]^2} > 0 \tag{A.14}$$

Since: $\frac{d(Nh)}{d\theta} = \frac{\delta N}{\delta \theta} h + \frac{\delta h}{\delta \theta} N$ it follows from (A.11) and (A.14) that:

$$\frac{dE}{d\theta} = \frac{d(Nh)}{d\theta} > 0 \tag{A.15}$$

Equating (A.8) and (A.6) yields the following solution for productivity per worker:

$$p(E) = p[N(\theta)h(\theta)] = \frac{(1-\beta)z}{[1-h(\theta)]^{\alpha} X(\theta)} \tag{A.16}$$

To get the relationship between migration and labour market tightness we totally differentiate (A.16) over the labour force and labour market tightness:

$$\frac{\delta p(E)}{\delta E} \frac{\delta E}{\delta L} dL = \left\{ -\frac{\delta p(E)}{\delta E} \frac{\delta E}{\delta \theta} + \frac{\alpha(1-h)^{\alpha-1} X(\theta) - X'(\theta)[1-h(\theta)]^{\alpha}}{[1-h(\theta)]^{2\alpha} X(\theta)^2} (1-\beta)z \right\} d\theta \tag{A.17}$$

Rearranging equation (A.17) we can write the derivative of labour market tightness from an increase in migration:

$$\frac{d\theta}{dL} = \frac{\frac{\delta p(E)}{\delta E}\frac{\delta E}{\delta L}}{\left\{-\frac{\delta p(E)}{\delta E}\frac{\delta E}{\delta \theta} + \frac{\alpha(1-h)^{\alpha-1}X(\theta)-X'(\theta)[1-h(\theta)]^{\alpha}}{[1-h(\theta)]^{2\alpha}X(\theta)^2}(1-\beta)z\right\}} \tag{A.18}$$

That is we note from (A.18) that labour market tightness is in fact a function of the size of the labour force. We note that $\frac{\delta p(E)}{\delta E} < 0$ by assumption. Since $\frac{\delta h}{\delta L} = 0$ from equation (A.10) we can say that $\frac{\delta E}{\delta L} = \frac{\delta N}{\delta L}h$, while from (7) $\frac{\delta N}{\delta L} = \frac{\theta q(\theta)}{\lambda+\theta q(\theta)} > 0$. It follows that the numerator of equation (A.18) is negative. The first term in the denominator of (A.18): $-\frac{\delta p(E)}{\delta E}\frac{\delta E}{\delta \theta}$ is positive since $-\frac{\delta p(E)}{\delta E} > 0$ by assumption while $\frac{\delta E}{\delta \theta} > 0$ from (7). Since the workers time endowment is normalised to unity $\alpha(1-h)^{\alpha-1} > 0$ while from (A.16) positive productivity implies $X(\theta) > 0$.

Differentiating $X(\theta)$ from (A.16) we get:

$$\frac{\delta X(\theta)}{\delta \theta} = -1 + q'(\theta)\frac{\alpha(1+\beta)(r+\lambda)c}{q(\theta)^2} < 0 \tag{A.19}$$

It follows that the term $-X'(\theta)[1-h(\theta)]^{\alpha}$ in the denominator of (A.17) is also positive. Finally since $[1-h(\theta)]^{2\alpha}X(\theta)^2$ and $(1-\beta)z > 0$ we have shown that the numerator of (A.17) is negative while all the various terms in the denominator are positive so that:

$$\frac{d\theta}{dL} < 0 \tag{A.20}$$

The derivative of hours per worker with respect to a change in migration is:

$$\frac{dh}{dL} = \frac{d\theta}{dL}\frac{\delta h}{\delta \theta} \tag{A.21}$$

Since $\frac{\delta h}{\delta \theta} > 0$ from (A.11) and given inequality (A.20), equation (A.21) implies that an increase in migration will lower labour market tightness and cause firms to reduce hours per workers.

Table A.1: Summary Statistics

	Incumbents		Recent Migrants	
Variable	***Mean***	***SD***	***Mean***	***SD***
Weekly Wage	1151.70	1215.86	1021.22	902.88
Weekly Working Hours	51.47	11.16	52.63	10.97
Salary Pay Period				
Hourly	0.00	0.05	0.00	0.05
Daily	0.51	0.50	0.53	0.50
Weekly	0.01	0.09	0.01	0.09
Monthly	0.48	0.50	0.46	0.50
Age	33.58	10.97	27.75	8.83
Single	0.31	0.46	0.47	0.50
Married	0.66	0.48	0.51	0.50
Widow	0.01	0.10	0.00	0.06
Divorced	0.01	0.09	0.00	0.07
Separated	0.01	0.11	0.01	0.11
Education Level				
None	0.03	0.16	0.01	0.12
Less than Pratom 4	0.02	0.15	0.01	0.12
Lower elementary	0.40	0.49	0.26	0.44
Elementary	0.22	0.42	0.35	0.48
Lower secondary	0.14	0.35	0.16	0.37
Upper secondary	0.05	0.22	0.08	0.26
Lower vocational	0.00	0.00	0.00	0.01
Upper and higher vocational	0.05	0.22	0.04	0.20
University academic	0.04	0.20	0.03	0.17
University technical vocational	0.04	0.19	0.04	0.21
Teacher training	0.01	0.09	0.01	0.08
Short Course vocational	0.00	0.01	0.00	0.01
Other	0.00	0.02	0.00	0.02
Firm Size				
1-4 employees	0.24	0.43	0.18	0.39
5-9 employees	0.24	0.42	0.18	0.39
10-19 employees	0.16	0.36	0.15	0.35
20-49 employees	0.11	0.32	0.14	0.34
50-99 employees	0.06	0.24	0.08	0.28
100-199 employees	0.16	0.37	0.22	0.41
200+ employees	0.03	0.18	0.05	0.22

Occupation				
Professional Occupation	0.05	0.22	0.05	0.21
Administrative Officer	0.02	0.13	0.01	0.10
Financial and Accounting Clerks	0.08	0.27	0.07	0.25
Wholesale/Retail Trader/Owner	0.05	0.22	0.06	0.23
Farmer/Fisherman/Hunter	0.13	0.33	0.09	0.28
Miner/Quarry Worker	0.00	0.05	0.00	0.04
Transportation	0.11	0.31	0.07	0.26
Cotton Spinner/Weaver/Knitter	0.36	0.48	0.41	0.49
Type Cutter/Printer/Bookbinder	0.15	0.35	0.16	0.37
Services/Sports	0.05	0.23	0.08	0.27
Industry				
Agriculture, Forestry and Fishing	0.13	0.33	0.09	0.29
Mining	0.01	0.09	0.01	0.08
Manufacturing	0.12	0.32	0.14	0.35
Rubber	0.17	0.38	0.22	0.42
Construction	0.25	0.43	0.25	0.42
Sanitary Services	0.00	0.03	0.00	0.04
Commerce	0.17	0.37	0.14	0.35
Transportation	0.05	0.22	0.03	0.18
Services	0.10	0.31	0.12	0.32
Others	0.00	0.02	0.00	0.02
Union dummy	0.05	0.21	0.04	0.21
Municipal area	0.41	0.49	0.45	0.50
Region				
Bangkok	0.12	0.33	0.12	0.33
Central region	0.36	0.48	0.41	0.49
North region	0.19	0.39	0.16	0.37
Northeast region	0.18	0.38	0.21	0.41
South region	0.15	0.35	0.10	0.29

Notes: Summary statistics are presented by migration status on the sample of working men in the private sector. Migrants and incumbents account for 21,872 and 194,410 observations, respectively.