THE DYNAMIC RELATIONSHIP BETWEEN FDI AND WAGES: EVIDENCE FROM THE PEOPLE'S REPUBLIC OF CHINA

Bala Ramasamy*
Nottingham University Business School, University of Nottingham

Matthew C.H. Yeung
School of Business and Administration, The Open University of Hong Kong

ABSTRACT
The objective of this paper is to evaluate the relationship between FDI and wage rates using the well-established Granger causality method but with a panel data setting. The paper considers the dynamic relationship between these two variables for 27 provinces over the 1985 – 2000 period. We also distinguish between the coastal and inland provinces. Results indicate that Granger causality runs from FDI to wages for the coastal provinces but no significant relationships are found for the inland provinces. These results imply that FDI is a contributing factor for increasing wage rates in China. In particular, our findings show that the "cheap labour" hypothesis does not apply for China. It further indicates that increasing inflow of FDI into the coastal provinces relative to the inland provinces exacerbate the unequal distribution of wealth between the regions.

Key Words: China, FDI, Wages, Granger causality

INTRODUCTION
For most of the 1990's, China has been the largest recipient of FDI among the developing countries and globally, second only to the US. UNCTAD (2002) report that foreign firms account for 23 percent of China's total industrial value added, 18 percent of tax revenue and 48 percent of total exports. It is thus not surprising that much has been written about FDI in China. As early FDI theories were developed based on the movement of capital which involved developed economies, many

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* Corresponding author. Address all correspondence to: Malaysia Campus, Wisma MISC, No. 2 Jalan Conlay, 50450 Kuala Lumpur, Malaysia. Tel.: +603-21408153. Fax: +603-21457297. Email: bala.ramasamy@nottingham.edu.my

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researchers have considered extending these theories to developing countries. The present study is an attempt in this direction.

In particular, this paper focuses on the relationship between FDI and wage rates. Conventional wisdom, supported by theories such as Dunning's eclectic paradigm (Dunning 1977, 1988), would opine that lower wage rates in the host country relative to the home country attract FDI. However, empirical studies have been unable to provide sufficient evidence to support this claim (UNCTC 1992, Chen 1996). More recent work by Feenstra and Hanson (1997) and Zhao (2001) seem to suggest that FDI actually raises the wage rates in the host country – Mexico and China respectively. This is plausible if FDI increases the demand for skilled labour and hence pushes up the wage rates of this type of workers.

Both strands of research tend to use regression techniques that take causality in one direction or another as given. Relatively lower wages attracting greater amounts of FDI and that FDI pushes up the average wage rates in the host country need not be contradictory. It is possible to argue that at an initial stage, a country's lower wage rates become a crucial determinant for FDI inflow. In the long run, however, as production moves up the value chain, the demand for skilled labour increases and in the process the average wage rates in the host country increases. If this were true, then one could hypothesize a bi-causality relationship between the two variables, rather than the uni-directional causality assumed by previous studies. The objective of this paper is to evaluate the relationship between FDI and wage rates using the well-established Granger causality method but with a panel data setting. The results of this study will be able to shed light into the direction of causality between these variables.

China offers an interesting case for the study of this relationship, not only due to the massive FDI which flows in yearly, but also due to the spatial variance in FDI and wage rates across its various provinces (Coughlin and Segev 2000, Bao et al. 2002). As shown in Table 1, the uneven spread of FDI is obvious. Seven top provinces – Guangdong, Jiangsu, Fujian, Shanghai, Shandong, Liaoning and Beijing account for about 75 percent of FDI into China between 1985 and 2000 while seven bottom provinces – Ningxia, Xinjiang, Guizhou, Gansu, Inner Mongolia, Yunnan and Shanxi account for a little more than one percent of FDI in the same period. It must be noted that while the top provinces are coastal or cities opened to foreign investment since the beginning of economic reforms, the bottom ones are inland provinces.

In Table 1, one can also note that the positions of these provinces in the time intervals i.e. 1985-1990, 1990 – 1995 and 1995 – 2000, do not vary dramatically. Guangdong remains to be the star attraction although the proportion has decreased from 43.1 percent in 1985-1990 to less than 30 percent in 1995 – 2000.

Table 1. FDI Inflow, 1985 – 2000, in percent

Province	1985-2000	1985-1990	1990-1995	1995-2000
Ningxia	0.0	0.0	0.0	0.0
Xinjiang	0.1	0.4	0.1	0.1
Guizhou	0.1	0.4	0.2	0.1
Gansu	0.1	0.0	0.1	0.1
In Mongolia	0.2	0.2	0.2	0.2
Yunan	0.3	0.2	0.3	0.3
Shanxi	0.4	0.0	0.2	0.5
Jiangxi	0.7	0.3	0.8	0.7
Jilin	0.9	0.5	0.9	0.9
Shaanxi	0.9	2.6	0.8	0.8
Anhui	0.9	0.6	1.0	0.9
Heilongjiang	1.1	1.3	1.0	1.2
Sichuan	1.2	1.1	1.9	0.9
Henan	1.3	1.0	1.1	1.4
Hunan	1.6	0.6	1.2	1.7
Guangxi	1.9	1.6	2.3	1.7
Hubei	2.0	0.9	1.8	2.1
Hainan	2.0	2.1	2.9	1.7
Hebei	2.0	0.9	1.4	2.2
Zhejiang	3.3	1.6	3.3	3.4
Tianjin	3.9	2.5	2.9	4.5
Beijing	4.1	9.7	3.4	4.0
Liaoning	4.5	4.6	4.5	4.4
Shandong	6.6	4.1	7.3	6.5
Shanghai	8.3	8.7	8.0	8.2
Fujian	9.8	7.1	11.0	9.5
Jiangsu	11.8	3.6	11.7	12.6
Guangdong	30.0	43.1	29.6	29.2

Note: Chongqing, Tibet and Qinghai are not included due to incomplete data.
Source: China Statistical Yearbook (various years)

In a similar fashion, following the layout in Bao et. al. (2002), Table 2 shows the growth of nominal wages between 1985 and 2000. There has been a general increase in wages across the provinces in the country. However, note the obvious similarities between the two tables. Provinces that were able to attract larger amount of FDI tend to experience higher wage growth rates and vice versa. The only exception seems to be Yunnan Province which attracted only 0.3 percent of FDI but had an annual wage rate growth of 15.3 percent. When the coastal provinces and inland provinces were considered separately, we find that the wages in the former has grown by a factor of 9.7 while the latter grew by a factor of 7.1. The direction of causality between FDI and wages are determined by using these spatial differences in China.

Table 2. Nominal Wage Rates Indices (1985=100) and Average Growth

Year	1985	1990	1995	2000	Average
Shanxi	100.0	192.3	430.0	630.1	13.3%
In Mongolia	100.0	168.6	377.5	636.9	13.3%
Gansu	100.0	179.0	408.4	636.4	13.4%
Xinjiang	100.0	179.2	418.8	682.6	13.8%
Henan	100.0	183.0	435.7	695.1	14.0%
Guizhou	100.0	182.6	419.8	700.6	14.0%
Shaanxi	100.0	187.0	402.6	714.7	14.2%
Ningxia	100.0	186.7	421.1	712.3	14.2%
Guangxi	100.0	190.3	474.0	710.4	14.2%
Jiangxi	100.0	179.0	435.9	726.1	14.5%
Anhui	100.0	192.3	485.2	735.7	14.5%
Hubei	100.0	185.3	456.2	736.6	14.5%
Hebei	100.0	193.6	464.0	746.0	14.6%
Heilongjiang	100.0	178.1	398.9	754.1	14.6%
Jilin	100.0	179.0	419.9	751.1	14.6%
Hunan	100.0	192.4	453.0	767.5	14.8%
Sichuan	100.0	194.7	449.7	805.7	15.1%
Hainan	n.a.	140.0	377.1	523.2	15.2%
Shandong	100.0	199.2	476.8	813.0	15.2%
Yunan	100.0	188.3	455.3	816.2	15.3%
Liaoning	100.0	204.9	461.6	828.1	15.3%
Fujian	100.0	204.0	552.5	998.5	16.8%
Guangdong	100.0	223.4	629.3	1054.4	17.3%
Tianjin	100.0	209.3	558.0	1071.2	17.3%
Jiangsu	100.0	205.3	573.1	993.2	18.0%
Beijing	100.0	197.5	606.4	1217.4	18.5%
Zhejiang	100.0	208.5	621.5	1227.8	18.5%
Shanghai	100.0	217.0	690.4	1378.8	19.3%

Sources and notes: As per Table 1.

The remainder of this paper is structured as follows. Section 2 reviews the theoretical literature and empirical evidence on FDI-wage relationship. The data and methodology are described in Section 3. Results of the study will be discussed in Section 4 while Section 5 provides conclusions and policy implications.

FDI AND WAGE RATES:
A Literature Review

Conventional wisdom would suggest that low wages attract FDI. Hymer (1976) hypothesizes that MNCs operate in an oligopolistic market structure where competition is intense and so locating production and service operations at lower cost locations may provide the firm the advantage it needs. Similarly, relative wage rates are frequently employed in analysis that use Dunning's OLI framework. The empirical evidence to suggest that lower wages attract FDI is, however, mixed, such that Chakrabarti (2001) in his survey analysis of previous work on the determinants of FDI classifies wage rate as "the most controversial of all potential determinants of FDI." The impact of wages on FDI ranges from a negative relationship to no relationship and even a positive association.

Goldsbrough (1979), Saunders (1982), Flamm (1984), Schneider and Frey (1985), Culem (1988) and Pistoresi (2000) find that low wage rates attract greater amounts of FDI. On the other hand, Owen (1982), Gupta (1983) and Edwards (1990) find insignificant association between the two variables. Husan (1997) explains that while low labour cost might be a necessary factor, other factors can counteract in such a way that unit cost of production in the host country may actually increase. Still, Caves (1974), Swedenborg (1979), Nankani (1979), Wheeler and Mody (1992), Lucas (1993) and Yang, Groenewold and Tcha (2000) find that increasing wages could actually increase FDI inflows. Lucas (1993), for example, explains that the positive association occurs if capital intensive FDI is able to substitute the high cost of labour. However, high wages could also become a deterrent to FDI inflows as it outweighs the benefits of greater capital intensity. The studies cited above, particularly those with significant results, would tend to support the notion that low/high wages attract FDI.

To evaluate the notion that FDI inflows tend to raise wage levels, one has to turn to micro level studies. Such firm-level researches tend to suggest a positive relationship. Aitken et al. (1996) found that a 10% increase in the share of foreign investment in regional/industry employment pushes wages by about 2.5% in Mexico and Venezuela. Lipsey and Sjoholm's (2001) extensive study of Indonesian firms found similar results and further showed that the presence of foreign firms significantly affect the wages paid by domestic firms as well. Recent work on wage differentials between foreign enterprises (FE) and local enterprises (LE) include Willem te Velde and Morrissey (2001) on five African countries, Ruane and Ugur

(2004) on Ireland and Ono and Odaki (2004) on Japan. There is general agreement that foreign firms pay higher wages than domestic firms (Lipsey 2001). Several reasons have been forwarded to support this practice. These include overcoming late-mover disadvantages (Blomstrom and Kokko 2003), attracting better workers (Lipsey and Sjoholm 2001) and reducing worker turnover resulting in the leakage of technology from foreign firms (Lipsey 2002, Feliciano and Lipsey 1999).

Evidence of the FDI-wage relationship is also mixed for China. Cheng and Kwan (2000) estimate the effects of wages on FDI in 29 Chinese regions from 1985 to 1995 and found that wage cost had a negative effect on FDI. Similarly, Coughlin and Segev (2000) found a negative relationship even when spatial dependence is accounted for. On the other hand, Chen (1996) and Head and Ries (1996) found no significant evidence to suggest that wages affected FDI inflow.

Wu (2000) explains how foreign firms can be instrumental in pushing the average wage levels. Using a two-country-two-good general equilibrium model, he explains how these international firms increase the relative wages of skilled labour to unskilled labour. Although these conclusions were not tested empirically, Wu provides data evidence to support the premise that wage rates increases are prominent in FDI concentrated sectors. Zhao (2001) utilizes micro data from an urban household survey comprising 4798 households across 6 provinces to explain the process by which foreign affiliates increase the wage rates. To entice skilled labour from the privileged sector (state-owned enterprises) and to cover for mobility costs, foreign firms offer a higher wage rate. This practice could raise the national wage levels. However, labour market segmentation, rather than multinationals seem to be the culprit for the uneven distribution of wages.

To summarize, theoretical foundations that link FDI to wages are readily available. However, empirical evidences are inconclusive as they suggest a negative, positive or no relationship between FDI inflow and wage levels. A negative relationship would be relevant for efficiency seeking FDI while a positive relationship indicates the wage increasing effects of FDI. The fact that both these relationships exist in previous studies of China motivates this study. A review of the empirical evidence shows correlation between the two variables. For various reasons previous studies have presented and modeled the causal relationship as unidirectional (either from wages to FDI or from FDI to wages). However, it is possible that, in many instances, causality could run in both directions and that over time there will be significant interaction between wages and FDI. Low wage rates had attracted large amounts of capital into China. At the same time, average wage rates have also been increasing. Therefore, there is strong rationale for hypothesizing a bi-causality scenario for the proposed relationships. In particular, causality analysis would be able to confirm or refute the "cheap labour" argument and at the same time, identify if FDI inflow increases the average wage levels. In this paper, we isolate these two variables and evaluate the direction of causality. Availability of Chinese provincial data for FDI inflow and wage rates allows this procedure to be undertaken.

Although our emphasis in this paper is the role of wage on FDI and vice versa, one should note that there are other factors that affect these variables, both directly and indirectly. OECD (2000) provides an exhaustive list of determinants of FDI in China, including market size, physical, financial and technological infrastructure, openness to international trade, enhancement in investment policies and investment promotion activities. In the same light, factors that contribute to wage differences among China's provinces include the degree of openness and geography (Kanbur and Chang 2001).

METHODOLOGY

Data for the empirical analysis were collected from *The China Statistical Yearbook* (various years). The provincial-level data were considered. The data source provides comprehensive data collection for all 31 provinces. Two principle indicators were needed for the current study: FDI and Wages. For provincial FDI data, there were no proper records prior to 1985. We therefore collected 16-year-observations from 1985 to 2000. Similarly, the average wage rate per worker[1] at provincial level for the same time period was also collected. Qinghai had zero FDI inflow for half of its available data while Tibet had no inflow of FDI for almost all years from 1985 to 2000. Hence, both provinces were not included in the analysis. Chongqing was also excluded from the analysis since the yearbook had no data for this province prior to 1996. Also, data prior to 1988 were not available for Hainan. Given all these, the current analysis is based on a panel data set which consists of 461 observations.

In order to address causality issues between two variables of interest, a Granger causality analysis is often employed. Granger's (1969) notion of causality states that, given the assumption that both X_t and Y_t are stationary series, "X_t is causing Y_t, if we are better able to predict Y_t using all available information than if the information apart from X_t had been used". Since the notion of 'all available information' is not easy to define and obtain, and for the purpose of operationalizing the notion, Granger's suggestion to regress Y_t on its own lags and a set of lagged X_t(s) has become the norm. If the coefficient(s) of lagged X_t(s) contributes significantly to the

[1] The variable 'average wages of staff and workers' is used in our study. 'Staff and workers' refer to persons who work in enterprises and institutions of state ownership, collective ownership, joint ownership, share holding, foreign ownership, and ownership by entrepreneurs from Hong Kong, Macao, and Taiwan, and other types of ownership and their affiliated units, excluding retired persons invited to work in any units again, teachers in the schools run by the local people and foreigners and persons coming from Hong Kong, Macao and Taiwan and working in the state-owned economic units.

explanation of Y_t, we may consider that X_t is *Granger causing* Y_t. However, in such bi-variate framework, the omission of other relevant variables may result in spurious causality. The advantage of a panel data application is that it is less affected by possible biases derived from the omission of relevant variables among the explanatory factors (Martinez-Ros, 2000, Wooldrigde, 2002). To extend this causality notion to the current application, let's consider a dynamic fixed effects model of the form:

$$y_{i,t} = \alpha_1 y_{i,t-1} + \ldots + \alpha_p y_{i,t-p} + \beta_1 x_{i,t-1} + \ldots + \beta_p x_{i,t-p} + (\eta_i + \varepsilon_{i,t}) \qquad (1)$$

where η_i denotes a fixed effect and $\varepsilon_{i,t}$ is a random disturbance; p is the number of lags that takes values from 0 to p. The model is dynamic due to the presence of lagged dependent explanatory variables $y_{i,t-p}$(s), which have unknown coefficients. In fact, this gives a common specification for those wishing to estimate a VAR[2] or test for Granger causality (Judson and Owen 1996, Wachtel 2001). An attractive feature of this approach is that it does not require models for $x_{i,t}$(s) series to be specific in order to estimate the parameters [a, β] (Bond 2002). In other words, the inclusion of the finite distributed lags of x(s) does not raise any extra special inference problems, and is therefore not an expository point. However, for such a panel data model with lagged dependent variables as the predictors, the within-group estimator (for the fixed effects models) and the GLS estimator (for the random effects model) are not applicable (see Hsiao, 1986 for details). Thus, we estimate the widely used model based on the GMM estimator suggested by Arrelano and Bond (1991). For technical details of the computational procedures, the reader is referred to Arellano and Bond (1991), Arellano and Bover (1995), Bond (2002), Judson and Owen (1996) and Rouvinen (2002). The test of causality of X to Y can be done by determining if the coefficient(s) [β(s)] of $X_{i,t}$ are equal to zero by employing a Wald test of joint significance (Rouvinen

[2] The econometric models estimated in this paper are a bi-variate VAR system. One may argue that there could be several controlling variables missing from the system. In contrast, one should also bear in mind that a known restriction of VAR estimations is that the method itself restricts the selection of additional variables. For the present case, given that the two equations are synchronized in their forms, an additional controlling variable may well be entered into one equation but not for another. Moreover, the additional controlling variable must also be plausibly related to the existing variables and act as their dependent variable in a new equation. Including all debatable variables without strong theoretical justifications could run into the risk of introducing new estimation error without adding predictive content and thus reduce forecasting accuracy. Nevertheless, the number of coefficients in each equation of a VAR is proportional to the number of variables in the VAR. In other words, additional variables imply loss in estimation efficiency. Taking these trade-off into account, and given that the estimation method used in the analysis technically accounts for time-constant unobserved factors, the authors decided to keep the number of variables in the VAR small for estimation efficiency and the possible risks discussed above.

2002, Doornik 1999, Doornik et al. 1999). A significant Wald test statistics would imply that *X* granger causes *Y*.

Stationary series are required in a usual fashion Granger causality analysis. Thus, we begin by checking our data's stationary property. All variables are log transformed. Two panel data unit root tests are employed - Breitung and Meyer (1994) and Choi's *Z* (2001). Breitung and Meyer (BM) (1994) derived the asymptotic normality of the Dickey and Fuller test statistics for panel data with a large cross-section dimension and a small time-series dimension. With such properties and the advantage of sidestepping the problem of heterogeneous individual effects, their test is quite suitable in the present context in that we are working on a dataset with moderate time series observation (Goddard and Wilson 2001). The BM test statistics can be generated by performing the following regression:

$$\Delta y_{it} = \mu_i + \beta y_{i,t-1} + \sum_{k=1}^{p_i} \theta_k \Delta y_{i,t-k} + \gamma_i t + \varepsilon_{it} \qquad (6)$$

where i =1, 2, …, 28 (28 provinces) and t =1, 2, …, 16 (1985-2000). Both the null and the alternative hypothesis of the BM test are identical to the usual Dickey-Fuller test. Under the null of the presence of a unit root, we are testing for β=0. In this test the heterogeneity is captured by an individual specific intercept.

Choi (2001) argued that many panel data unit root tests assume the number of panels to be infinite and all panels have the same type of stochastic component. He proposes three panel data unit root tests: *P*, *Z* and *L*. These tests combine *p*-values of a uni-variate unit root test with the underlying concept of meta-analysis. Choi's test statistics offer the greatest degree of flexibility when compared with other panel data unit root tests. It runs with an unbalanced panel and it allows for individual specification (e.g. different lag for each country) for each panel. Among the three tests, it was found that the *Z* test appears to perform the best. Therefore it is used here as an additional diagnostic statistics to the earlier BM statistics. The test statistics can be obtained by performing equation (7).

$$Z = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \Phi^{-1}(p_i) \qquad (7)$$

where Φ( ) is the standard normal cumulative distribution functions. The null hypothesis again implies that the data are unit-root non-stationary. Reject the null hypothesis if the test statistics is less than the lower tail of the standard normal distribution. The BM and Choi' *Z* statistics are reported in Table 3.

Both test statistics clearly show that the data included in our analysis have the stationary property by rejecting the null hypotheses. Therefore, the data can be subjected to the subsequent Granger causality analysis.

Table 3. Panel data unit root tests for FDI and Wages (1985-2000)

Series	BM	Choi's *Z*
FDI	-4.598*** (0)	-3.7949***
	-4.232*** (1)	
	-3.473*** (2)	
Wage	-5.500*** (0)	-5.9684***
	-4.387*** (1)	
	-4.498*** (2)	

*** represents significance at the 1% level; numbers in parentheses are *k*(s) in equation (6); Choi's *Z* test statistics were calculated using individual specification of each panel resulting from a usual general-to-specific modeling strategy.

The disparity in FDI inflows among the provinces in China, as explained above, also motivates us to distinguish between the inland and the coastal provinces. It is well-known that there is a large degree of migration from the inland provinces to the coast. Bao et al. (2002), for example, state the disparity of wages as a possible reason. If the inland provinces have relatively low wage rates, then *ceteris paribus*, one would imagine that greater FDI should flow to these regions, i.e. wages granger causes FDI. Alternatively, in the coastal region one could assume that increasing levels of FDI would, ceteris paribus, push wage levels higher i.e. FDI granger causes wages. Both arguments are tested in our model. Our definition of inland provinces is a modified version of University of Michigan's China Data Center. The deep inland provinces are categorized as the western zone covering 56.3 percent of total land area and 23 percent of the population. The western zone comprise of 9 provinces: Shaanxi, Gansu, Ningxia, Xinjiang, Qinghai, Sichuan, Guizhou, Yunnan and Tibet (www.chinadatacenter.org). Due to data limitations, as explained previously, we excluded Qinghai and Tibet. In our categorization of inland provinces, we have also included Inner Mongolia due to its remoteness. As a result inland provinces in this study are Xinjiang, Ningxia, Sichuan, Yunnan, Gansu, Shaanxi, Guizhou and Inner Mongolia. All other provinces were aggregated and defined as coastal.

RESULTS AND DISCUSSION

Table 4 reports the results of the investigation of the causality relationship between FDI and WAGES.

When all provinces are included in the analysis, the Wald tests of joint significance for β(s) of FDI are all statistical significant indicating that there is a certain degree of causality running from FDI to WAGES as a whole. On the other hand, the Wald tests for joint significance of β(s) of WAGES are all statistically insignificant. Thus, our analysis is unable to provide any statistical support to show causality running from WAGES to FDI as a whole.

Our finding may surprise some China observers since much has been written about the "cheap labour" of China. The average labour costs is said to be 5 percent of those in developed countries (*China Daily*, 7 November 2002) and six times cheaper than Mexico (*BBC News*, 11 November 2002). In other words, relatively lower wage rates alone may not be an attractive feature of China. Our results are further amplified in the comparison between inland and coastal provinces. When only the inland provinces are included in the analysis, all Wald tests are statistical insignificant (at the 5% significance level) regardless of how many lags were included. It would also appear that the significant results (p-value=0.0245) for the WAGES equation with two lags of FDI occurred only by chance. This indicates that FDI and WAGES are independent in the inland provinces. When the coastal provinces were singled out in the estimation, for joint significance of β(s) of WAGES are statistical significant (at the 1% significance level) but the Wald tests for joint significance of β(s) of FDI are statistical insignificant. The results appear to endure irrespective of how many lags were included into the equations. This would suggest that WAGES in these locations does appear to be influenced by FDI but not vice versa.

Contrary to recent skepticism of FDI's promotion of economic welfare among host economies (Hanson, 2001), our findings seem to provide more support to the view that entry of multinationals into developing countries, like China, raises the productivity of labor and hence the wage rates, as described by Rodriguez-Clare (1996).

Table 4. Granger Causality between FDI and Wage Rates

Sample	Does FDI>WAGES?			Does WAGES>FDI?		
	Lag	Wald	*p*-value	Lag	Wald	*p*-value
Inland	1	2.2582	(0.1329)	1	2.8069	(0.0939)
	2	7.4183*	(0.0245)	2	0.0393	(0.9805)
	3	2.6910	(0.4418)	3	5.6347	(0.1308)
Coastal	Lag	Wald	*p*-value	Lag	Wald	*p*-value

	1	76.0660**	(0.0000)	1	0.4305	(1.0000)
	2	51.9720**	(0.0000)	2	5.4134	(0.7969)
	3	44.4440**	(0.0000)	3	1.2615	(0.9737)
All	Lag	Wald	*p*-value	Lag	Wald	*p*-value
	1	80.5830**	(0.0000)	1	0.0124	(1.0000)
	2	42.6660**	(0.0000)	2	3.6359	(0.9337)
	3	35.5880**	(0.0000)	3	0.4579	(0.9983)

** and * represent significance at the 1% and 5% , respectively. Note: Causality tests beyond 3 lags were not considered for two reasons. First, common practice would suggest that analysis with yearly data need not include more than 2 lags. Second, as the analysis was conducted using a panel data set with a relatively short time periods, retaining reasonable estimation efficiency with long lag lengths can be problematic.

The results obtained above that FDI G*ranger causes* WAGES, should be interpreted with some caution. Our causality test is built based on a bi-variate system. In other words, our system of equations does not take into account other control variables that might directly affect both the variables in question. The estimation technique we used controls for the unobserved time-constant effects and we allow the error term of the model to capture the effects of time invariant together with the time-varying unobserved provincial characteristics. Wooldridge (2001) suggests that this could be a drawback in certain panel data applications, but when the interest is only on time-varying explanatory variables, it is acceptable to ignore modeling factors that are not of direct interest. However, one could ask: could the omission of variables inflate the strength of the causality? While possible in principle, but forming a spurious causality seems unreasonable. The reasons are that the major source of spurious regression in panel data comes from the fact that the variables included in the model contain non-stationary properties (Entorf 1997, Baltagi 2001). As we find that FDI and WAGES are both stationary series, the probability of spurious phenomena occurring is significantly reduced. Additionally, the introduction of the dynamic is also a useful cure for spurious regression. Although we could not conclude how much causation is generating from FDI on WAGES, to a large extent our results provide insights on the direction of the causation, which complement a plausible theoretical narrative for China's situation.

The results obtained above do not necessarily imply that FDI contributes 'positively' to wage rates. To confirm this we proceed to regress WAGES on FDI using the conventional panel data regression methods. This allows us to investigate the contemporaneous relationship between FDI and WAGES i.e. the sign of the regression coefficient would reveal whether FDI positively contributes towards increasing the population's average wage rates or if the opposite is true.

As the causality is significant only among the coastal provinces, the regression procedures carried out below considers the coastal sample only. We first considered all four common panel data model specifications: one/two-way fixed effects (FE) model and one/two-way random effects (RE) model. In an FE model, the error term is assumed independent of the independent variable, FDI in our case. On the other hand, in a RE model the error term is correlated with the independent variable. Some diagnostic statistics could be used to determine which specification is better between FE and RE. We use the conventional Breusch and Pagan's Lagrange multiplier (*LM*) and Hausman (*H*) test statistics to guide our selection. In a one-way error component model, the time-constant but cross-sectional variant unobserved effects are controlled. Apart from time-invariant effects there may still be time-varying effects that affect the FDI-Wages link. These effects can be controlled by allowing for time effect, the so called two-way models[3], in the sense that the estimating function vary over time because of factors such as changes in government regulation. Researchers often face the challenge of deciding which model specification to be employed. Using our sample, the two-way model with the inclusion of time effects imply a severe loss in efficiency. As a result, the estimated coefficient was found to be insignificant[4] from zero, hence does not complement with our previous analysis (see panel B of Table 5). Hence, the one-way model seems to be more appropriate when considering the estimation efficiency. In fact, most of the panel data applications utilise a one-way model and let the error term to represent the remainder time-varying disturbances. According to Wooldrige (2001), it is unwise to allow for time effect when *T* (number of time periods) is relatively large to *N* (number of cross sections). This condition applies in our data sample.

[3] Alternatively, an obvious approach is to add more relevant independent variables into the model to account for the unobserved time-varying effects. However, it is difficult to determine which time-varying variables are to be included into the model. Even by doing so, it still remains an open question as to what extent the newly included variables capture the relevant effects. Besides, it is often not easy to identify which variable is time varying and which is not. For example, education is a logical proxy for skill and it is evident that skilled labour is one of the determinants of FDI. Thus, one could find a relationship between skill and FDI. On the other hand, it is reasonable to consider education and skill as the determinants of Wages. One may assume education as a time-varying variable but, surprisingly, the percentage of gradates in the population is still below 3% and this figure has not changed much across time in recent years nor does one expect it to change dramatically in the next few years. Given all these, this approach is usually not recommended (Annacker and Hildebrandt 2002)

[4] The inclusion of time effect very often inflate the R^2 but it is opposite in our case. To some extent, this is indicative of the two-way model is not the appropriate specification.

The *LM* test statistics determines whether or not the panel data may be treated as pooled data and therefore allowing for OLS to be used for the function estimation. Otherwise, the function has to be estimated by panel data procedures, either FE or RE. The null hypothesis of the *LM* test assumes that a random effect model is the correct specification for the data against the alternative hypothesis which suggests a classical regression model is preferable. The *H* test statistics is helpful in determining - between FE and RE - the procedures that should be employed. Under its null hypothesis, the RE estimator is consistent. Rejecting the null would imply a FE estimator is more appropriate. In our computations, a significant *LM* statistics (*LM* = 477.460 [*p*-value=0.000]) and an insignificant *H* statistics (H = 1.81 [*p*-value=0.178]) were found. These indicate that RE is the most suitable method for our estimation. Moreover, the assumptions of RE is more appropriate from an omitted variable perspective (Wooldridge 2001). The estimated coefficients for regression of WAGES on FDI using the RE method is reported in Table 5.

Table 5. Regressing Wages on FDI –
One Way Error Component Random Effects Model for Coastal Provinces

Panel A: One Way Error Component Random Effects Model				
	Coefficient (b)	Standard Error (St.Er.)	b/St.Er.	*p*-value
Constant	8.311***	0.215	38.614	(0.000)
FDI	1.889***	0.075	25.265	(0.000)
			R^2=	0.588
Panel B: Two Way Error Component Random Effects Model				
	Coefficient (b)	Standard Error (St.Er.)	b/St.Er.	*p*-value
Constant	3.537***	0.092	38.431	(0.000)
FDI	-0.00316	0.010	-0.330	(0.7413)
			R^2=	<0.010

*** represents significant at 1% level.

As expected, the contemporaneous impact of FDI on WAGES is statistically significant. The sign of the coefficient is positive, implying that FDI helps improve the average wage rates of China's coastal population. The particularly high value of R^2 is an indicative of the significant contribution of FDI on average wage rates. Due to computational constraints, our model specification is selected based on an estimation efficiency perspective; hence it is worth noting that our results may not be used to describe the strength of the FDI-WAGES relationship. However, it is by all means providing a sensible insight on the sign of the proposed relationship.

CONCLUSION

This paper examined the causal linkages between FDI and wage rates across the provinces in China over the period 1985 to 2000. Granger causality tests on a panel data set were conducted for this dynamic model. Our main findings are that there is a one way causal link between FDI and WAGES, and that this is particularly relevant for coastal provinces. The findings, however, should be considered subject to several limitations. First, we consider only wages as labor remuneration. Other forms of compensations are ignored. Second, we consider only average wage rates. Wages may differ from industry to industry or even from firm to firm. Firm level study could overcome this limitation. Third, the omission of control variables in the Granger causality tests could have affected our results. For instance, the lack of proper infrastructure might have a stronger effect on the small level of FDI in the inland provinces. Furthermore, the present study is an intra-provincial study. The degree of differences between the provinces might be smaller as compared to inter-country studies. The relatively small intra provincial differences could mask the relationships that may exist between the variables in question.

Despite the limitations, the implications of our findings are, first, relatively lower labour costs cannot solely be used as an attracting incentive for FDI, especially in the long term. Although the inland provinces have lower wage rates, no significant relationship is obvious between the two factors. It is possible then that other determinants of FDI, like infrastructure, market potential or transportation cost, are more important reasons for attracting FDI. Second, the capability of FDI to increase wage rates and hence productivity is obvious. This is in line with theoretical arguments that higher wage rates are a consequence of FDI inflow (Brown, Deardorff and Stern 2002). Recent micro level studies in developing countries bear testimony to this (Willem te Velde and Morrissey 2001). Promoting FDI in China brings direct positive economic results. As other capabilities improve in China's inland provinces, the wage increasing benefit of FDI in the coast could be realized as well. Third, if lower wage rates are not the primary attracting feature of FDI, failure to improve other determinants of FDI in the inland areas would exaggerate further the income inequality that already exist. As explained earlier, a larger portion of FDI flows into the coastal provinces that are already relatively advanced in terms of infrastructure, market potential etc. Ceteris paribus, the wage levels in the coast will thus continue to increase, leaving the inland provinces further behind in the race to economic wealth.

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