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Making the Best of FDI for Chinese Workers

Foreign Direct Investment, Wages and Education in China

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Abstract

This paper develops a framework which demonstrates why a significant effect of foreign direct investment (FDI) on average wages might be conditional on the human capital endowment of the receiving economy. Consequently, the reasoning is tested using the case of Chinese prefecture-level cities. While the main hypothesis of this paper is not confirmed by the empirical analysis, it might still apply to other developing countries where more extreme variations in education levels exist.

1 Introduction:

Understanding the effects of foreign direct investment (FDI) has occupied economists for a long time (Chen et al., 2011). Many developing countries try to attract this kind of capital in the belief that it will create and facilitate sustainable growth as well as the adoption of new technologies unknown to the domestic economy (Ge, 2006). The effects of FDI on the receiving economy however, are not always entirely clear. This applies especially to the case of wages (Brown et al, 2003). Yet a proper understanding of these effects should be the basis of policies directed towards foreign investors. It is crucial that policy makers understand which conditions have to be met to ensure the potential benefits of foreign investment and to make the best of FDI for their economy.

As the biggest receiver of inward foreign direct investment (Ge, 2006) China has been the center of attention of many studies and researches analyzing the effects of FDI on growth and productivity. By now there is also a growing literature on the effect of FDI on both wages paid at a firm level and wage inequalities across skill-groups. However, only a few attempts have been made to analyze the impact of foreign direct investment on average wages in different Chinese provinces or cities. These effects are arguably relevant to policy makers as they give an indication of how wages are affected under different circumstances on a more aggregate level. Furthermore they illuminate the extent to which the domestic workforce benefits from the inflows of foreign capital.

This paper analyzes the effect of the FDI stock on average wages in Chinese prefecture-level cities. As Ge (2006) points out, those cities present an interesting opportunity to analyze this effect since the distribution of FDI across regions is highly uneven in China. In doing so, this paper adds to the already existing literature in two ways: First, the hypothesis that FDI has a positive effect on average wages is tested once more with a rich panel covering 288 cities from 1996 to 2009. Second, a framework is designed and tested which demonstrates that a significant effect of the stock of FDI on average wages might be conditional on the human capital endowment of the receiving economy – in the case considered the human capital of Chinese cities.

This conditionality could be present for three different reasons: First, FDI flows differ in their technology intensity bringing the most (advanced) technologies to economies with a rather

educated workforce. Second, the human capital endowment determines how well an economy can absorb and hence benefit from spillover effects. Third, firms investing in economies with a low-educated labor force are more sensitive to labor costs which might dampen the growth of wages. This reasoning is mainly based on the literature; in particular on contributions made by Blomström et al. (2002) and Liu et al. (2010). To test the framework, the Chinese cities in the sample are ranked on the basis of two education variables and consequently divided into three subgroups: cities with a low, medium and high human capital endowment.

While the empirical analysis does not yield the expected results – in several specifications the FDI stock also has a positive and significant effect in the lowest human capital endowment group – the framework might still apply in other developing countries where education levels are generally lower or vary more extremely across regions. It is argued that - when tested in or across other countries – the framework might still provide interesting insights into the nexus of FDI, wages and education.

The remainder of this paper is structured as follows: After reviewing the existing literature in section two, the mechanism explaining why and how human capital might make a difference to the effect of FDI on wages is presented in section three. Consequently, the data as well as the construction of the variables used in the empirical analysis is described in section four. Section five introduces the empirical methodology employed to derive the results which are presented and discussed in section six. Section seven concludes.

2 Literature

In this section the existing literature on the nexus of FDI, education and wages is presented. After reviewing several theoretical explanations of how FDI affects wages, the findings of empirical studies are discussed. A brief description of the endogeneity issues surrounding the relationship between FDI and wages concludes the literature review.

2.1 How FDI affects wages

Brown et al. (2003) identify four major channels through which FDI may affect wages. However, they argue that on theoretical grounds alone neither of them has an unambiguously positive or negative effect. *First,* FDI adds to the capital stock of a country thereby increasing

the marginal productivity of labor and hence wages. While Brown et al. (2003) state that this is indeed the most likely outcome, they also present two models which predict either no effect or even wage decreases suffered by unskilled workers. *Second*, FDI inflows can make new technologies available which will increase productivity and therefore put an upward pressure on wages. However, the authors claim that the effect of higher productivity crucially depends on the interaction of supply and demand on labor markets. If companies would - for example - respond by increasing the share of labor in the production process relative to other factors of production, wages might not change at all. *Third*, FDI can be the result of an outsourcing process. Brown et al. (2003) claim that this can have different effects on wages depending on both the factors in which the outsourced process is intensive and the relative factor endowments of the receiving country. *Fourth*, their size might give multi-national companies (MNCs) monopsony power; especially if their entry drove local competitors out of the market. While MNCs could use this position to reduce wages there might be other factors (e.g. negative publicity) which might prevent them from doing so. As is shown in subsection 2.3, foreign firms indeed tend to pay a wage premium relative to domestic firms (Chen et al., 2011).

Wu (2000) makes an important contribution to the literature by combining the impact of foreign capital on wages with education levels. He investigates the effect of FDI on relative wages paid to skilled and unskilled workers. Wu argues that even small amounts of FDI can have a significant effect on wages as the latter tend to be set at the margin. Yet, the effect of FDI appears to depend on the sector it is directed to: Sectors intensive in skilled labor seem to have experienced a more rapid wage growth than those intensive unskilled labor. This however, is contrary to the standard Heckscher-Ohlin/ Stolper-Samuelson reasoning. Since FDI is mainly focused on exports and seeks to benefit from China's cheap labor, it would be expected that the relative returns to China's abundant factor - unskilled labor – will increase. Wu resolves this contradiction by introducing a general equilibrium trade model with product differentiation. He finds that technology advancements as well as a tendency towards high(er) quality products will increase the demand for and hence the wages paid to skilled labor. This in turn will contribute to wage inequality as the remuneration of skilled labor increases relative to the one of unskilled labor. Wu's model is indeed consistent with the findings of empirical studies focusing on the returns to skilled and unskilled labor presented below.

Also Hale et al. (2008) consider the connection between FDI, skill-level and wages at a firm level. Even though their reasoning is not formalized in the form of a model their research adds to the theoretical literature presented so far by making the link between FDI and labor market competition effects more explicit. They note that there still is a shortage of skilled workers in China which are vastly outnumbered by their unskilled counterparts. It is that abundance of lowly educated people, they argue, which keeps foreign invested firms from paying unskilled workers above regional wages. In other words, their entrance does not affect the bargaining power of unskilled labor in a significant way. The small group of skilled workers, however, will benefit from the additional demand for their labor and hence receive higher wages. The empirical findings of Hale et al (2008) - which are presented in section 2.3 in more detail – seem to confirm their reasoning.

A more general connection between education and the impact of FDI was articulated by Blomström et al. (2002). They argue that economies with a low level of human capital will attract investments which are less technology-intensive and therefore less likely to significantly enhance the productivity of local workers. Moreover, they claim that low education levels might attenuate possible spillover effects regarding technology, knowledge and productivity since the economy is simply not capable of absorbing them. Less educated workers are less likely to fully comprehend technologies or management techniques used in foreign invested firms and apply them outside their working place. Blomström et al. (2002) therefore conclude that those economies with the best human capital endowment will benefit the most from FDI.

2.2 Evidence from different countries

As Ramasamy et al. (2010) argue the overall macro evidence regarding the effect of FDI is not entirely unanimous but hints in the direction of a positive impact. Freeman et al. (2001) cannot identify a significant effect of FDI on wages using a sample of developing countries. Feenstra and Hanson (1997) however find that foreign direct investment increased the demand for skilled labor in Mexico so that the share of total wages received by more educated workers increased. Figini et al. (1999) obtain similar results analyzing the impact of multi-national companies on wages in the Irish manufacturing sector. According to their findings, wage inequality follows an inverted U-shape over time: Initially wage inequality is increased

as mainly skilled workers gain from the influx of new technologies. After several years, however, positive spillover effects on domestic firms alleviate wage inequality and also less skilled workers benefit from higher wages.

2.3 FDI and Wages in China

This subsection starts with three studies on the firm level. They were included as they show a clear link between FDI and wages. In line with research conducted in other countries[1] - foreign invested companies (FIC) in China were found to generally pay higher wages than domestic firms (Chen et al., 2005; Chen et al., 2011). According to Chen et al (2011) this could be due to the incentive of FICs to keep turnover of labor low such as to minimize the risk of for instance technology leakages. Furthermore workers might prefer to work for domestic companies and therefore need to be offered a premium to accept a position with a FIC.

As was mentioned above Hale et al. (2008) argue that competition effects increase the wages of skilled workers in China. In their empirical analysis they also investigate the wage effects of FDI on a firm level. They find that FDI has a positive effect on the wages of skilled labor employed in private firms; the wages of unskilled labor are not affected. While this study does not explicitly test the effect of FDI on average wages, the result that wages paid to skilled labor are affected positively while the remuneration of unskilled workers does not change implies that average wages can be expected to be increased by FDI.

Ramasamy et al. (2010) analyze the relationship between average wages and FDI streams in China on a provincial level. The time frame considered ranges from 1988 to 2007. While allowing for differences between coastal and inner provinces their explanatory variables are limited to productivity and FDI inflows. They find that FDI indeed has a weak yet significant positive effect on average wages which is more pronounced in the coastal areas where most of China's FDI is concentrated.

Wenhui Fan (2006) also considers average wage data from Chinese provinces ranging from 1981 to 2001. However, she employs a wider set of explanatory variables than Ramasamy et

[1] See for instance Feliciano and Lipsey (2006) for the USA or Lipsey and Sjoholm (2004) for Indonesia.

al. (2010). Her overall findings confirm that lagged FDI inflows have a positive and significant effect on average wages even after allowing for market size (provincial GDP) and remoteness (measured by the distance between the province's capital and the closest coast). The latter variable is shown to have a negative and significant effect indicating that also geographical factors play an important role in determining wage differences. What is striking however, is that Fan finds the effect of her education variable – the share of the population with secondary or higher education – to be negative and significant.

Ge (2006) finally analyzes the effect of FDI inflows on average wages paid in Chinese cities. Using prefecture-level city data from 1990-1998 he finds that FDI has a positive and significant effect on real average wages after allowing for the city specific capital labor ratio and sector composition. Moreover, he shows that a higher human capital endowment – measured by the share of the population with nine (twelve) years of formal education in 1990 - is also associated with higher wages.

The literature presented above clearly indicates that FDI can be expected to have a positive and potentially significant effect on average wages. Also, it appears that the education level of single workers or the entire workforce can make a difference to this effect. This paper adds to the literature in the following two ways: First, the hypothesis that the stock of FDI has a positive effect on average wages is tested with a rich panel covering 288 cities from 1996 to 2009. Second, a framework is designed and tested which demonstrates that a significant effect of the stock of FDI on average wages might be conditional on the human capital endowment of the receiving economy. To summarize, the hypotheses described and tested in this paper are:

Hypothesis 1: The stock of FDI has a positive and significant effect on average wages observed in Chinese prefecture-level cities.

Hypothesis 2: A significant effect of the FDI stock on average wages is conditional on the human capital endowment present in a city.

To test the first hypothesis a regression model with time and city fixed effects is employed. To test the second hypothesis the Chinese cities are divided into three subgroups according to

their human capital endowment. Consequently, the regression analysis is repeated for the highest and the lowest human capital group.

The main framework explaining how and why human capital endowment could make a difference to the effect of FDI on average wages is presented in the next section. It is in part based on the literature presented above. Before this is done, however, the problem of endogeneity surrounding the relationship of FDI and wages is discussed briefly.

2.4 Endogeneity

Endogeneity is a big challenge aggravating the proper analysis of the nexus of FDI, education and wages. Among others Sun et al. (2002) find that FDI flows are negatively associated with higher wages. Since foreign companies seek to minimize costs, they prefer regions with lower labor costs. As Ge (2006) points out, this might cause the effect of FDI on wages to be underestimated. The most common way to deal with this problem is the use of lags. Following Ge (2006) and Chen et al. (2011), lagged independent variables are used in this research to address the potential endogeneity bias.

3 Theoretical Model: How does FDI affect wages?

The section above provides an overview of different channels through which FDI can affect wages in China and elsewhere. The main hypothesis of this paper, however, is that the *significance* of the FDI effect on wages is conditional on the human capital endowment of the receiving economy. This section presents a theoretical model that shows why and how this hypothesis could hold true in the case of the Chinese cities considered.

Following the reasoning of Blomström et al (2002) Chinese cities with a low human capital endowment are likely to attract less technology-intensive FDI which in turn does not present a significant improvement over already existing means of production. Also, spillover effects are less likely to occur since employees are not able to make use of the foreign firms' expertise outside their workplace. Both factors therefore limit the potential productivity gains from FDI and hence mitigate the possible increase in average wages.

FDI flowing to cities with a high human capital endowment however, is likely to be more technology intensive and therefore provides a better basis for productivity gains. Also, spillover effects are more likely since educated workers will find it easier to apply the knowledge obtained from the foreign investors within domestic firms. The spillovers in turn will result in higher demand and competition for skilled labor which will drive up average wages even further.[2]

In addition to this foreign firms in China seem to be more sensitive to wages if their main business activity involves rather low skilled labor (Liu et al, 2010). This means that they are generally more reluctant to increase their workers' pay during wage negotiations. Assuming that those firms are mainly located in cities with low human capital endowment, this is yet another factor that would hamper wage growth relative to other cities with a more educated labor force.

In conclusion, the size of the FDI-effect on urban average wages is likely to be conditional on the level of human capital endowment for three reasons: First, FDI flows differ in their technology intensity bringing the most (advanced) technologies to cities with a rather educated workforce. Second, the human capital endowment determines how well a city can absorb and hence benefit from spillover effects. Third, firms investing in cities with a low-educated labor force are more sensitive to labor costs which might dampen the growth of wages. The framework is summarized in Figure1.

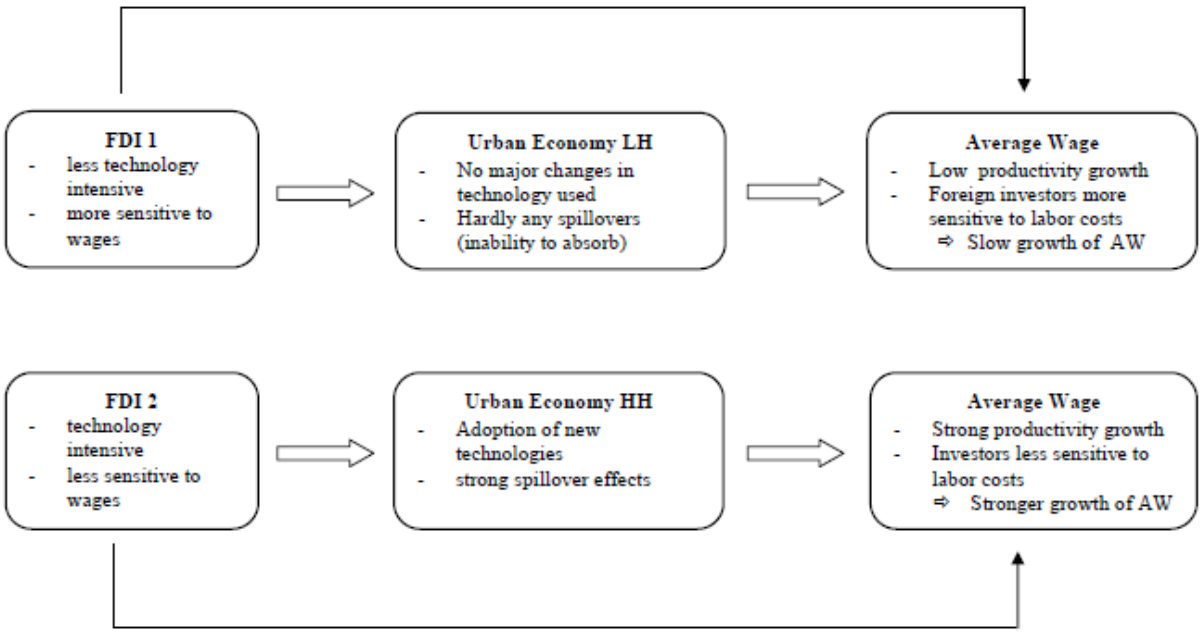

Figure 1- Effect of FDI on Wages depending on human capital endowment

[2] Another reason why wages might increase under the circumstances outlined above is that foreign firms pay their employees a premium in order to keep them from quitting their job and spreading knowhow among domestic competitors (Lipsey, 2004).

4 Data and Construction of Variables

The dataset used in this paper was obtained from www.cinadataonline.com which provides data taken from the Chinese Urban Statistical Yearbook. The latter is published by the Chinese State Statistical bureau. The final dataset comprises 282[3] Chinese prefecture level cities[4] and covers a time frame spanning from 1996 to 2009. The official exchange rates used to convert the amount of FDI quoted in US dollars into Renminbi were taken from the World Bank's World Development Indicators database. After discussing several shortcomings of the panel, this section continues to explain the choice of variables and describe their construction in more detail if necessary.

4.1 Shortcomings

One of the problems of the dataset used in this study is missing observations. Not for every city data is available for all years. What is a more severe problem, however, is the lack of a proper education variable. The share of the population holding a certain degree would present a good indication of human capital endowment. However, this kind of information is not publicly available. Therefore, other suitable proxies had to be employed. Another concern is the accuracy of the average wage variable. The wage data provided in the Urban Statistical yearbook relies on surveys of workers and staff members rather than the entire workforce. Hering and Poncet, (2009) argue that this might cause the data to be overstated. Finally, it is important to note that city-level price indices were not publicly available. Therefore, a transformation of nominal variables into real variables was not possible.

4.2 Choice and Construction of Variables:

Dependent Variables: The dataset offers two variables which qualify as outcome variables: average wage and GDP per capita. The former, used by – among others - Ge (2006) and Ramasamy (2010) – refers to the simple average of the annual remuneration received by an

[3] Six cities had to be excluded from the analysis due to missing FDI or education data. Those cities are: Baiyin, Fangchenggang, Zhongwei, Shuozhou, Jiayuguan and Karamay

[4] Hering and Poncet (2009) who use the same source point out that the information in the dataset refers to the urban part of those cities.

employee in a certain city. The latter divides a city's annual GDP by its total population at a year's end. Since the wage variable represents the actual amount of money paid to an average worker it is preferred over GDP per capita which also comprises retained profits or investments which do not directly benefit workers. However, since the data on GDP per capita suffers from less missing observations and reliability issues (Hering and Poncet, 2009) GDP per capita is used to check the robustness of the main analysis.

FDI stock: The FDI stock was calculated following Hering and Poncet (2009) assuming an annual depreciation rate of 5%:

$$FDI\ stock_t = FDI\ stock_{t-1}\ (1 - 0.05) + FDI_t$$

where FDI_0 is equal to the FDI inflow in 1996[5]. The stock was preferred over annual FDI streams as a share of GDP as it better reflects foreign commitment to a region. It is important to note that the definition of FDI employed in the Chinese data is different from the standard definition used by the IMF[6]. According to Buckley et al. (2002, page 8) the Chinese definition comprises: "(…) all expenditures that add to the capital of a firm". Based on the literature review the sign of this variable's coefficient is expected to be positive.

Investment Stock: Throughout this paper *Investment* refers to investments in fixed assets. Following Buckley et al. (2002) it is considered to be equivalent to domestic investment. The *Investment Stock* was also calculated assuming an annual rate of depreciation of 5% (Hering and Poncet, 2009):

$$I\ stock_t = I\ stock_{t-1}\ (1 - 0.05) + I_t$$

where again I_0 is equal to the investment made in 1996. Since investments in fixed assets increase the capital intensity of production and therefore also the workers' productivity, the effect on wages is expected to be positive.

[5] In the regressions below the impact of the FDI or investment stocks present before 1996 are captured by the use of city fixed effects (Hering et al, 2009). In case no values were available for 1996, the first following observation was used as I_0.
[6] IMF (1977)

Education 1: Following Hering and Poncet. (2009), the first education variable is obtained by dividing the number of students enrolled in institutions of higher education[7] by the number of a city's inhabitants. While it can be argued that it is not certain whether students will stay in the same city after their graduation, this variable still qualifies as a proxy for human capital endowment due to the structure of the Chinese system of higher education. Atsushi (2002) argues that there has been a long tradition of "studying while working" in China which means that the knowledge acquired by students is likely to be immediately available to companies. Moreover, it could be argued that firms have a strong incentive to retain workers who are currently studying and keep them from moving to other places. Hering and Poncet (2009) indeed find the variable to have a positive and significant effect on income which is consistent with the findings of similar researches using more sophisticated education variables.

Education 2: As a robustness check, a second education variable was constructed dividing the number of institutions of higher education by the total city population. In China cooperations between universities and companies seem to be quite common (Atsuhsi, 2002). Therefore, the number of universities present in a city might give an indication of the ability to create (and absorb) knowledge directly available to firms. Moreover, a similar reasoning as in the case of *Education1* applies: Given that students tend to be already employed by companies located near their school, they are likely to stay after their graduation. Hence, it is reasonable to assume that cities with a higher density of institutions of higher education have a higher human capital endowment in general. Both education variables are expected to have a positive effect on wages as a better human capital endowment should translate into higher overall productivity of labor and hence a higher average remuneration.

Employment: This variable represents the share of employed people in the total population. Since a larger workforce deteriorates the bargaining power of single workers while a smaller one tends to improve it, the expected sign of this variable is negative.

Sector Employment Share Ratio: Following Ge (2006) this variable is obtained by calculating the ratio of people employed in the secondary sector to those employed in the tertiary sector. It is therefore a proxy for the structure of employment. Since business activites performed in

[7] In Hering and Poncet (2009, page 14) the following definition of institutions of higher education is given: "Institutions of higher education refer to establishments which have been set up according to government evaluation and approval procedures, enrolling high-school graduates and providing higher-education courses and training for senior professionals. These include full-time universities, colleges, and higher/further education institutes." For simplicity, they are referred to as 'universities' throughout the rest of the paper.

the tertiary sector are likely to be more skill intensive (Ge, 2006), the sign of this variable is expected to be negative.

Population: This variable refers to the total population living in a city at a year's end. In the further analysis it is taken as a proxy for city size. While particularly big cities might attract a lot of unskilled labor and therefore have lower average wages, it is not entirely certain whether the coefficient of this variable will be positive or negative.

5 Empirical Approach

This section presents the empirical approach of this paper. It is divided into two parts: First, the general model employed to test hypothesis 1 and 2 is explained and motivated. Second, the construction of the three education groups relevant to the analysis of hypothesis 2 is described.

5.1 Regression Model

The effect of the FDI stock on average wages is tested by an ordinary least squares (OLS) model. To allow for unobservable, time-invariant differences across cities city fixed effects are introduced. Moreover, time fixed effects are included to control for possible changes in external factors which affect all cities in the same way and at the same time. The main regression model therefore is[8]:

$$Y_{i,t} = \beta_0 + \beta_1 FDI_{t-1,i} + \beta_2 Inv_{i,t-1} + \beta_3 Edu_{i,t-1} + \beta_4 SecShare_{i,t-1} + \beta_5 Pop_{i,t-1} + \gamma T_{t-1} + \delta D_i + \varepsilon_{i,t}$$

where Y refers to either average wage or GDP per capita, *FDI* and *Inv* represent the stock of FDI and investment in fixed assets since 1996 respectively and Edu stands for either of the two education variables presented in section 4.2. *SecShare* furthermore refers to the sector share variable and *Pop* to total population at a year's end. Finally, D_i and T_t represent city and time fixed effects respectively. As can be seen from the equation above, the independent variables are lagged by one year to deal with possible endogeneity problems.

[8] For the ease of interpretation the logarithmic transformation was applied.

While the OLS assumption of normally distributed errors is likely to hold due to the large sample size, a Wooldridge test for panel datasets revealed that the assumption of no autocorrelation of the error terms is violated (see Appendix, Table A16 and A17). To allow for this, clustered White standard errors are used which not only compensate for serial correlation within clusters – here the different cities – but also allow for heterogeneity.

The estimation of the equation above is used to test the first hypothesis that FDI has a positive effect on wages. Later on interaction-terms between FDI stock and the two education variables, *Education1* and *Education2*, are included in order to obtain a first indication whether education makes a difference to FDI or not. Finally, the equation is estimated for different subgroups of cities. The construction of these groups is described in the following subsection.

5.2 Ranking and Formation of Human Capital Groups

To further explore whether a significant effect of FDI on average wages is conditional on the human capital endowment of a city, the panel is divided into three groups of same size: cities with low, medium and high human capital endowment. To determine which city belongs in which group, all cities are ranked according to the average value of *Education1*, the number of students as a share of the total population. Consequently, the 94 cities with the lowest values are grouped in group1 (low human capital endowment), the following 94 in group 2 (medium human capital endowment) and the remaining 94 in group3 (high human capital endowment).

Finally, the regression equation given above is estimated for both the lowest and the highest education group to determine whether the effect of the FDI stock differs between the two. In order to test the reliability of the results, the whole procedure is later on be repeated using *Education2*.

The division into three groups is based on Card and Krueger (1990) who used this approach to identify whether returns to schooling are conditional on school quality in different US states.

While it is a rather intuitive method, it does not have a theoretical basis which means that the obtained results have to be interpreted with care.

6 Results and Discussion

This section reports and discusses the empirical results of the regressions described above. To keep the analysis as clear as possible it is divided into three parts: the analysis of the full sample, the analysis of the subsamples and a broader discussion of the obtained results. Furthermore, in case regression results are discussed in more detail, the dependent variable referred to (either average wages or GDP per capita) is mentioned at the beginning of the respective paragraph.

6.1 Full Sample

Average Wages: The results obtained for the basic model using average wages (1) show that the FDI stock indeed has a positive and significant effect on average wages (Table1). A 1% increase in the FDI stock in period t-1 on average gives rise to a 0.03% increase in the average wage in period t (ceteris paribus). Similarly, the investment stock is shown to have a significant and positive effect. The employment variable – while having the expected negative sign - is not significant in this specification; neither is *Education1*. The ratio of employment in the secondary to employment in the tertiary sector, however, is negative and significant. This confirms the findings of Ge (2006) and suggests that average wages paid in the Chinese tertiary sector are indeed higher than the ones paid in the secondary sector. Finally, the population variable also has a negative and significant effect on average wages: on average an increase in population size will lead to a decrease of 0.1% of wages (ceteris paribus). This implies that average wages in big cities tend to be lower than in smaller ones. Repeating the analysis using *Education2* (2) hardly affects the results obtained for the other variables (see Table1) and again confirms the hypothesis that the FDI stock has a positive and significant effect on average wages. Also this education variable is not significant and has a negative sign.

However, it is important to note that *Education1* was found to be correlated with both the investment and the FDI stock (see Appendix, Table A6). While this could be a potential source of collinearity bias, the results obtained with *Education2* - which is less correlated with the stock variables - are similarly insignificant. The correlations of the other variables considered in regressions (1) and (2) (see Appendix, Table A6) do not raise any concerns regarding possible collinearity problems: Only the stock of investment and FDI are highly correlated. Still, both variables enter the regression with the expected sign and clearly significant t-values.

Variables	(1) LN Wage	(2) LN Wage	(3) LN GDP	(4) LN GDP
lfdi_stock	0.0300***	0.0299***	0.0435**	0.0431**
	(0.00838)	(0.00831)	(0.0207)	(0.0206)
lInv_stock	0.0708***	0.0706***	0.214***	0.214***
	(0.0203)	(0.0202)	(0.0272)	(0.0272)
lEmpl	-0.0144	-0.0135	0.0504***	0.0487***
	(0.00968)	(0.00952)	(0.0148)	(0.0153)
lLShare2_3	-0.0700***	-0.0707***	-0.0218	-0.0245
	(0.0148)	(0.0151)	(0.0200)	(0.0202)
lpop	-0.104*	-0.103*	-0.196***	-0.183***
	(0.0570)	(0.0560)	(0.0603)	(0.0612)
lEdu1	-0.00921		0.0107	
	(0.00820)		(0.0127)	
lEdu2		-0.00903		0.0287*
		(0.00914)		(0.0164)
Observations	3,027	3,016	3,027	3,016
R-squared	0.961	0.961	0.929	0.929
Number of city_id	265	265	265	265

Table1: Regression Results Full Sample

Note: Robust standard errors in parentheses; GDP refers to GDP per capita;
***, ** and * refers to a p-value of 1, 5 and 10% respectively

GDP per capita: Repeating the analysis with GDP per capita as the dependent variable confirms the overall results obtained above (Table 1, specification (3)). Only some changes are noteworthy: First, the size of the investment stock coefficient more than tripled: An increase of the investment stock by 1% increases GDP per capita by on average 0.21% (ceteris paribus). This is probably due to the fact that – by definition – an increase in investments increases GDP whereas the effect on wages is less direct and will need more time to realize. Second, both education variables now have a positive sign and *Education2* is

significant at the 10%-level. Third, in contrast to the findings above and the results obtained by Hering and Poncet (2009), the effect of the employment variable is positive and significant. Intuitively, this result makes sense as GDP per capita will increase as a higher share of the population is working. Average wages, however, might suffer from this as the relative bargaining power of an individual worker deteriorates. Again, the correlations of the variables considered did not give any indication of possible collinearity problems (Table A7). All specifications considered so far confirm the first hypothesis: In line with other research FDI indeed seems to have a positive and significant effect on average wages observed in Chinese cities. To further explore whether this positive and significant effect is conditional on the human capital endowment of a city, the above analysis is repeated using the subsamples described in section 5.2[9].

6.2 Subsamples – Education1

Average Wages: As can be seen in Table 2 the grouping based on *Education1* does not support the main hypothesis of this paper. Using average wages (5-6) the effect of the FDI stock has a positive and significant effect in both group1 and group3; the significance level of group1 (1%-level) being lower than the one of group3 (10%-level). In cities with a low and cities with a high human capital endowment a 1% increase in the stock of FDI on average leads to a rise in average wages of 0.038% (ceteris paribus). As far as the other variables are concerned the results are similar to the ones obtained for the full sample. Still, the employment and population variables are no longer significant in the low human capital endowment group. Moreover, the education variable in group3 now has a negative and significant effect on average wages. This last result concurs with the findings of Wenhui Fan (2006). Unfortunately, neither her nor this contribution to the literature can offer an adequate explanation for it.

GDP per capita: The results of using GDP per capita as the outcome variable (7-8) also run to the contrary of the second hypothesis. Here, the FDI stock is found to have no significant effect in either group1 or 3. Except for the employment variable which is not significant in both groups, the other results are rather similar to the ones obtained using the full sample.

[9] The use of interactions between FDI stock and the respective education variable turned out to be not feasible because of severe collinearity problems.

As a robustness check the ranking and consequent grouping of the Chinese cities was repeated using *Education2*. The results are summarized in Table3 and are discussed in more detail in the following paragraphs.

Average Wages: Again no support for hypothesis 2 is found: Using average wages as the dependent variable (9-10) the stock of FDI has a positive and significant effect in both groups. In cities with a low human capital endowment a 1% increase in the FDI stock on average leads to a 0.023% increase in average wages (ceteris paribus). In cities with a strong human capital endowment the same change in FDI stock is associated with a 0.038% increase in the dependent variable (ceteris paribus). As above, the variables for employment and population are no longer significant in group1 while the education variable still has a negative and significant effect on average wages.

Dependent Variables:	LN Wage		LN GDP	
	(5)	(6)	(7)	(8)
Variables:	Group1	Group3	Group1	Group3
lfdi_stock	0.0375***	0.0376*	0.0198	0.0237
	(0.0115)	(0.0197)	(0.0149)	(0.0228)
lInv_stock	0.115**	0.0626**	0.160***	0.219***
	(0.0469)	(0.0251)	(0.0367)	(0.0464)
lEmpl	0.00234	-0.0465***	0.0452	0.0335
	(0.0199)	(0.0171)	(0.0319)	(0.0226)
lLShare2_3	-0.0531*	-0.0939***	0.0437	-0.0464
	(0.0294)	(0.0225)	(0.0282)	(0.0320)
lpop	-0.200	-0.115**	-0.118*	-0.478***
	(0.176)	(0.0454)	(0.0599)	(0.0655)
lEdu1	0.00963	-0.0382**	0.00592	-0.00498
	(0.0113)	(0.0148)	(0.0159)	(0.0245)
Observations	855	1,165	855	1,165
R-squared	0.928	0.977	0.931	0.952
Number of city_id	87	93	87	93

Table2: Regression Results Subgroups – Ranking Based on Education1

Note: Robust standard errors in parentheses; GDP refers to GDP per capita;
***, ** and * refers to a p-value of 1, 5 and 10% respectively

GDP per capita: Using GDP per capita as the outcome variable (11-12) the effect of the FDI stock is significant in group1 while it is insignificant in group3. Compared to the ranking based on *Education1* several other variables change as well: The population is no longer

significant in group1 while the sector share variable becomes significant in group3. Interestingly, now also the education variable has a positive and significant effect on income in group3.

Clearly, the results of this subsection do not present evidence in support of the hypothesis that the effect of the FDI stock on wages is conditional on human capital. Rather, in several specifications the FDI stock variable was also significant in the lowest education group. The following subsection provides several possible explanations for this outcome.

	LN Wage		LN GDP	
	(9)	(10)	(11)	(12)
VARIABLES	Group1	Group3	Group1	Group3
lfdi_stock	0.0230***	0.0384*	0.0606**	0.00605
	(0.00841)	(0.0195)	(0.0288)	(0.0224)
lInv_stock	0.121***	0.0828***	0.168***	0.266***
	(0.0261)	(0.0291)	(0.0332)	(0.0533)
lEmpl	-0.00268	-0.0419**	0.0299	0.0113
	(0.0140)	(0.0160)	(0.0246)	(0.0279)
lLShare2_3	-0.0679***	-0.0885***	0.0161	-0.0756**
	(0.0251)	(0.0276)	(0.0358)	(0.0366)
lpop	-0.337	-0.0978**	-0.118	-0.387***
	(0.277)	(0.0438)	(0.0905)	(0.112)
lEdu2	0.0163	-0.0278**	0.00903	0.0452*
	(0.0170)	(0.0135)	(0.0269)	(0.0231)
Observations	874	1,110	874	1,110
R-squared	0.962	0.975	0.919	0.943
Number of city_id	86	91	86	91

Table3: Regression Results Subgroups – Ranking based on Education2

Note: Robust standard errors in parentheses; GDP refers to GDP per capita;
***, ** and * refers to a p-value of 1, 5 and 10% respectively

6.3 Possible Explanations of the Results

The fact that the FDI stock was shown to have a positive and significant effect on average wages in both group1 and group3 could be an indication that the reasoning of Blomström et al. (2002) does not apply to the case of Chinese cities: First, FDI might actually bring considerable improvements in production technologies even to those cities that have a relatively low human capital endowment. Second, while the group1 cities might be poor in human capital *relative* to the other cities, their endowment might still be sufficient for them to

benefit from spillovers of new technologies introduced by FDI. This is to some extent supported by Qian and Smith (2005) whose results indicate that – as far as education is concerned - the widest and most pressing gap in China exists between urban and rural areas. Hence, the results could be explained by (a) a human capital endowment in group1 cities which is low relative to other cities yet by itself high enough to attract FDI-related technology inflows and benefit from the resulting spillovers; and (b) by the possibility that the gap between group1 and group3 in terms of human capital is simply not big enough.

Another reason why particularly average wages rather than GDP per capita are positively affected by FDI could be that - as stated above – wages are set at the margin (Wu, 2002). Following this reasoning it would take relatively more FDI to significantly affect GDP per capita rather than wages. This is reflected in the grouping based on *Education1*: While the stock of FDI is significant in both groups using average wages as the outcome variable, it is not significant in either group once GDP per capita is employed.

The results obtained with the grouping based on *Education2*, however, contradict the reasoning above. Now the FDI stock also has a positive and significant effect on GDP per capita. These results could be in line with the findings of Jin et al. (2008). Using a panel of Chinese provinces they discover that over time FDI lost its role in significantly contributing to growth and other, predominantly domestic factors related to knowledge and innovation took over. If the cities in group1 indeed are behind regarding their development relative to group3 cities, this would mean that in the first group FDI still plays an important role in creating GDP per capita growth while in the third group other, predominantly domestic factors contribute to it. Based on the obtained results it is unfortunately not possible to determine with certainty which reasoning applies to the Chinese cities.

7 Conclusion

This paper has designed a framework which relates the effect of FDI on average wages to the human capital endowment of an economy. In particular, it was argued that a significant effect is conditional on the human capital endowment for three reasons: First, FDI flows differ in their technology intensity bringing the most (advanced) technologies to economies with a rather educated workforce. Second, the human capital endowment determines how well an economy can absorb and hence benefit from spillover effects. Third, firms investing in

economies with a low-educated labor force are more sensitive to labor costs which might dampen the growth of wages.

To test the reasoning presented above, the case of Chinese cities was considered. Several panel regression with both city and time fixed effects confirmed results of earlier researches. It was found that FDI indeed has a positive and significant effect on average wages once all cities are considered together. Consequently the sample was split into three groups: cities with low, medium and high human capital endowment. Rerunning the regressions for those subgroups did not yield any support for the main hypothesis of this paper. In several specifications the effect of FDI on wages was significant even in cities with a low human capital endowment. Hence, at least in the case of the Chinese cities considered the effect of FDI on wages seems to not be conditional on the human capital endowment.

In an attempt to explain these results several possible reasons were given. First of all the reasoning explained above might not apply to the case of Chinese cities. The cities in the lowest group might be poor in human capital *relative* to other cities and yet rich enough to attract and benefit from technology intensive FDI inflows. Second, the difference in human capital endowment might simply not be large enough between the different groups. Which explanations are in fact true is a potential area for future research.

The education variables employed in the analysis are an important limitation of this research. It would be interesting to see whether the results change once more precise measures such as the share of the population holding a certain degree are used. Furthermore, a different ranking with a stronger theoretical basis could yield different results. Together with these two potential improvements the inclusion of remoteness indicators as well as the use of a more sophisticated statistical model are possible areas for future research. Finally, it would be interesting to test the framework outlined above in different (or even across) developing countries where educational differences are more extreme. This could help to understand how developing countries can make the best of FDI; not only for the economy at large but also for their workforce.

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Appendix

Table A1: Summary Statistics Full Sample

Variable	Obs	Mean	Std. Deviation	Min	Max
Av Wage	3742	13724.98	9038.727	2668.09	240683.6
GDPpc	3823	1.4685	2.013554	0.0234905	34.2287
fdi_stock	3712	1786591	5938926	0	7.84E+07
Inv_stock	3712	961.996	2035.339	0	32369.18
LShare2_3	3658	0.9325813	0.5444907	0.0803782	4.513721
Population	3872	407.845	292.7657	28.99	3275.61
EduH	3585	0.0090137	0.0145458	0	0.1228067
Uni_Pop	3541	0.0139468	0.0173399	0	0.1173845
Empl	3704	0.1684728	0.1843875	0	2.484926

GDP per capita, Population and FDI stock in ten thousands Yuan, Investment stock in 100 Millions Yuan

Table A2: Summary Statistics Group1 – Ranking based on Education1

Variable	Obs	Mean	Std. Deviation	Min	Max
Av Wage	1211	12494.58	9484.763	2668.09	240683.6
GDPpc	1266	0.835495	0.8334384	0.0234905	14.45678
fdi_stock	1218	359108.5	846357.7	0	1.02E+07
Inv_stock	1218	415.9744	559.8807	0.76	4719.902
LShare2_3	1179	0.8070105	0.5612502	0.104445	4.374582
Population	1289	381.5979	232.5025	28.99	1360.04
EduH	1098	0.0017456	0.0013814	0	0.0085423
Uni_Pop	1080	0.0045314	0.0037081	0	0.0438212
Empl	1204	0.1282276	0.1556243	0	0.6789104

GDP per capita, Population and FDI stock in ten thousands Yuan, Investment stock in 100 Millions Yuan

Table A3: Summary Statistics Group3 – Ranking based on Education1

Variable	Obs	Mean	Std. Deviation	Min	Max
Av Wage	1293	15773.52	9407.434	3741.07	63549
GDPpc	1304	2.323829	2.827538	0.0955882	34.2287
fdi_stock	1302	3892890	9441238	0	7.84E+07
Inv_stock	1302	1750.993	3119.333	1.54	32369.18
LShare2_3	1286	1.106912	0.5731953	0.0892857	4.513721
Population	1308	451.2887	393.2795	31.49	3275.61
EduH	1279	0.0196116	0.0201109	0	0.1228067
Uni_Pop	1281	0.0278078	0.022204	0	0.1173845
Empl	1293	0.2243735	0.2087817	0.0483307	2.484926

GDP per capita, Population and FDI stock in ten thousands Yuan, Investment stock in 100 Millions Yuan

Table A4: Summary Statistics Group1 – Ranking based on Education2

Variable	Obs	Mean	Std. Deviation	Min	Max
Av Wage	1205	12073.02	6480.135	3383	41090.34
GDPpc	1259	0.7943932	0.578581	0.0234905	4.361512
fdi_stock	1205	457329.6	990698.8	0	1.02E+07
Inv_stock	1205	511.6465	654.2	0	5067.962
LShare2_3	1161	0.7015112	0.3708901	0.104445	3.456942
Population	1277	456.1478	218.2644	29.7	1360.04
EduH	1093	0.0035371	0.0018816	0	0.021411
Uni_Pop	1093	0.0035371	0.0018816	0	0.021411
Empl	1188	0.117095	0.1567569	0	0.6907024

GDP per capita, Population and FDI stock in ten thousands Yuan, Investment stock in 100 Millions Yuan

Table A5: Summary Statistics Group3 – Ranking based on Education2

Variable	Obs	Mean	Std. Deviation	Min	Max
Av Wage	1292	15801.79	9422.46	2668.09	63549
GDPpc	1297	2.408655	3.003128	0.1500235	34.2287
fdi_stock	1274	3897810	9504743	0	7.84E+07
Inv_stock	1274	1597.482	3040.654	1.99	32369.18
LShare2_3	1286	1.164838	0.6481426	0.0892857	4.513721
Population	1306	358.3171	272.4727	31.49	1400.7
EduH	1257	0.0289074	0.0218047	0	0.1173845
Uni_Pop	1257	0.0289074	0.0218047	0	0.1173845
Empl	1291	0.2341852	0.2091214	0.0301645	2.484926

Table A6: Correlations Regression Variables Full Sample – Average Wages

Variables	Av. Wage	lfdi_stock	lInv_stock	lEmpl	lLShare2_3	Lpop	lUni_Pop	EduH
Av. Wage	1							
lfdi_stock	0.5912	1						
lInv_stock	0.8322	0.7691	1					
lEmpl	-0.2885	-0.0156	-0.2541	1				
lLShare2_3	0.0317	0.1692	0.0622	0.4552	1			
Lpop	0.0001	0.3449	0.3738	-0.2369	-0.2352	1		
lUni_Pop	0.3159	0.3526	0.3263	0.391	0.2781	-0.2246	1	
EduH	0.4666	0.4698	0.5345	0.1737	0.101	0.0892	0.7088	1

Table A7: Correlations Regression Variables Full Sample – GDP per capita

Variables	GDPpc	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop	lEduH
GDPpc	1							
lfdi_stock	0.7171	1						
lInv_stock	0.7601	0.769	1					
lUni_Pop	0.5465	0.3541	0.3271	1				
lEmpl	0.1817	-0.0149	-0.2539	0.3909	1			
lLShare2_3	0.3636	0.172	0.0636	0.2777	0.4552	1		
Lpop	-0.1061	0.3429	0.3729	-0.224	-0.2366	-0.2333	1	
lEduH	0.6691	0.5681	0.6497	0.7887	0.1084	0.1868	0.0409	1

Table A8: Correlations Regression Variables Subgroups: Ranking Based on Education1 – Group 1 (Average Wages)

Variables	flwage	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flwage	1						
lfdi_stock	0.5057	1					
lInv_stock	0.8201	0.6715	1				
lUni_Pop	0.2733	0.0888	0.1591	1			
lEmpl	-0.4736	-0.1793	-0.4628	0.0257	1		
lLShare2_3	-0.0368	0.1786	0.025	0.1436	0.4953	1	
Lpop	-0.1341	0.1262	0.1849	-0.3531	-0.1458	-0.2354	1

Table A9: Correlations Regression Variables Subgroups: Ranking Based on Education1 – Group 3 (Average Wages)

Variables	flwage	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flwage	1						
lfdi_stock	0.6345	1					
lInv_stock	0.847	0.8228	1				
lUni_Pop	0.3825	0.345	0.4611	1			
lEmpl	-0.2989	-0.0575	-0.2418	0.1414	1		
lLShare2_3	-0.0919	-0.1229	-0.1343	-0.2174	0.2326	1	
Lpop	0.1331	0.585	0.5453	0.1804	-0.0952	-0.2406	1

Table A10: Correlations Regression Variables Subgroups: Ranking Based on Education1 – Group 1 (GDP per capita)

Variables	flgdppc	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flgdppc	1						
lfdi_stock	0.6656	1					
lInv_stock	0.7637	0.6715	1				
lUni_Pop	0.2998	0.0888	0.1591	1			
lEmpl	-0.0713	-0.1793	-0.4628	0.0257	1		
lLShare2_3	0.3129	0.1786	0.025	0.1436	0.4953	1	
Lpop	-0.2136	0.1262	0.1849	-0.3531	-0.1458	-0.2354	1

Table A11: Correlations Regression Variables Subgroups: Ranking Based on Education1 – Group 3 (GDP per capita)

Variables	flgdppc	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flgdppc	1						
lfdi_stock	0.7325	1					
lInv_stock	0.7915	0.8228	1				
lUni_Pop	0.3795	0.345	0.4611	1			
lEmpl	0.0516	-0.0575	-0.2418	0.1414	1		
lLShare2_3	0.0879	-0.1229	-0.1343	-0.2174	0.2326	1	
Lpop	0.116	0.585	0.5453	0.1804	-0.0952	-0.2406	1

Table A12: Correlations Regression Variables Subgroups: Ranking Based on Education2 – Group 1 (Average Wages)

Variables	flwage	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flwage	1						
lfdi_stock	0.4733	1					
lInv_stock	0.8137	0.6382	1				
lUni_Pop	0.6385	0.3964	0.6076	1			
lEmpl	-0.4351	-0.2142	-0.4674	-0.2579	1		
lLShare2_3	-0.0448	0.0833	-0.0428	0.0267	0.5209	1	
Lpop	-0.0378	0.2574	0.2772	-0.0097	-0.3608	-0.4372	1

Table A13: Correlations Regression Variables Subgroups: Ranking Based on Education2 – Group 3 (Average Wages)

Variables	flwage	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flwage	1						
lfdi_stock	0.6258	1					
lInv_stock	0.8413	0.8104	1				
lUni_Pop	0.683	0.5601	0.6948	1			
lEmpl	-0.2833	-0.0587	-0.2732	-0.1284	1		
lLShare2_3	-0.0391	-0.0085	-0.054	-0.1395	0.2369	1	
Lpop	0.0615	0.5165	0.4921	0.1725	-0.1857	-0.1751	1

Table A14: Correlations Regression Variables Subgroups: Ranking Based on Education2 – Group 1 (GDP per capita)

Variables	flgdppc	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flgdppc	1						
lfdi_stock	0.5483	1					
lInv_stock	0.7139	0.6382	1				
lUni_Pop	0.5478	0.3964	0.6076	1			
lEmpl	0.0335	-0.2142	-0.4674	-0.2579	1		
lLShare2_3	0.3661	0.0833	-0.0428	0.0267	0.5209	1	
Lpop	-0.2692	0.2574	0.2772	-0.0097	-0.3608	-0.4372	1

Table A15: Correlations Regression Variables Subgroups: Ranking Based on Education2 – Group 3 (GDP per capita)

Variables	flgdppc	lfdi_stock	lInv_stock	lUni_Pop	lEmpl	lLShare2_3	lpop
Flgdppc	1						
lfdi_stock	0.7149	1					
lInv_stock	0.7655	0.8104	1				
lUni_Pop	0.5706	0.5601	0.6948	1			
lEmpl	0.0921	-0.0587	-0.2732	-0.1284	1		
lLShare2_3	0.1644	-0.0085	-0.054	-0.1395	0.2369	1	
Lpop	0.0114	0.5165	0.4921	0.1725	-0.1857	-0.1751	1

Table A16: Wooldridge test for autocorrelation in panel data – Average Wages:
H0: no first-order autocorrelation

F(1, 259) = 189.025	*Prob > F = 0.0000*

Table A17: Wooldridge test for autocorrelation in panel data – GDP per capita:
H0: no first-order autocorrelation

F(1, 259) = 11.392	*Prob > F = 0.0009*