Empirical Research on the Influences of VAT Reform on Regional Factor Input Investment: According to China's Prefecture Level Panel Data from 2002 to 2010

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Abstract: From its transformation to expansion, the internally progressive logic of China's Value Added Tax ("VAT") reform has been ever-present in its scope for collections and deductions. An excellent sample of this could be seen in the decade of data preceding and following the VAT transformation in observing the implications of the VAT reform. By using the Two-Firms Model and China's 255 prefecture-level cities' panel data, this paper applies DID to test the impact of the VAT reform upon regional investments, employment, and wages overall. Many key conclusions arose. This includes that through layoffs rather than pay-cuts, the VAT transformation has promoted the "substitution of capital for labour". Also, after "Business to VAT", enterprises now prefer to use deductible outsourcing services rather than their own services, and that the VAT reforms and its accompanying time lag has seen more long-term impact than short term. Finally, the VAT reform has given birth to an "intertemporal tax avoidance" in mirroring observable postponing of investments. With the progressive advancement of "Business to VAT", future research directions could include examining trends in empirical data to compare implications of differing VAT systems that accompany their disparate reforms.

Key words: VAT reform; Factor Input; Investment Intensity; Employment Rate; Wage Level

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I. Introduction

The principle of the Value Added Tax (VAT) is preventing the 'double taxing' phenomenon observed in traditional sales tax collection, which has been the most implemented tax type across the world. Approximately estimated that there are more than 140 countries in worldwide are using it. As the first and most important tax type in China, the VAT has a profound influence on the economy, and subsequently its research has always been a focal point for both disciplines of tax theory and governance overall.

Since the introduction of the VAT in 1979 to the China, numerous reforms have been made. Especially, from the expansion of the VAT to incorporate outputs into the tax consideration process in 1994, to the inclusion of inputs into tax consideration in 2009, then to the launch of 'Business to VAT' in 2012._The main thread and evolution logic of VAT reform is the expansion of the scope of collection and deduction. Throughout the reform process of VAT, we find that the empirical data of 10 years before and after the transformation provide a good test sample for us to study the economic effect of VAT reform, especially the impact on factor input. How to effectively evaluate the effectiveness and shortcomings of the transformation will undoubtedly provide us with good experience in predicting and evaluating the policy effect of "replacing business tax with VAT".

Theoretically, different types of VAT systems will change the relative prices of capital cost and labour cost due to the different deduction scope, and then change the optimal ratio of input of production factors. In other words, the greater the deducting intensity of a class of production factors, the higher the input proportion of such factors will be.

Referencing the Cobb-Douglas production function $Y = AK^{\alpha}L^{1-\alpha}$; factor inputs could be represented in terms of capital inputs (K) and labour inputs (L), with labour inputs defined as a product of the total workers and their respective salaries. In applying this to VAT reforms, it could be theorised that the enterprises' likely gravitation towards the purchase of fixed assets grants a fixed cost ceiling. This subsequently maximises inputs by utilising 'capital labour substitution' in 'human-replacing machines' to reduce aggregate labour inputs overall. With the specific policies of the 'Business to VAT' reforms, enterprises would likely also increase their outsourcing efforts in relation to transportation and tertiary industry services, whilst simultaneously reducing its overall capital deployments and in-house labour investments.

Catalysed by the expanding scope of VAT collections, changes to allocating factors of production are becoming increasing institutionalised. In such a context, several questions undoubtedly emerge. What is the extent of empirical, allocative changes truly observed in the factors of production used? What is the size of disparity in factors of production allocation between areas with and without VAT reforms? And finally, what are current identifiable trends in the impact of VAT reforms from short- and long-term perspectives? These questions aim to attain an objective perspective in the Chinese VAT system. By recognising the role of VAT in influencing factor of production allocations, a theoretical and empirical basis to advance future VAT reforms can begin to emerge.

Grounded by China's long-term economic reliance on investments and the observable circumstance of the "middle income trap", this paper anchors the VAT reforms as a valuable case study to employ the 'Difference in Differences' ("DID") methodology. By referencing 255 valid prefecture-level cities' data between 2002-2010, analysis of temporal and spatial variability reveals the VAT reforms' impact on investment, employment, and wage levels overall. The structure of this paper is as follows: The second part reviews and comments on the relevant literature; In the third part, two kinds of firm theoretical models are developed. The fourth part is the regression model and the data description; The fifth part gives the empirical result and explanation and reveals the intertemporal difference of reform effect. The last part is the conclusion, deficiency, and prospect.

II. Literature Review

Previous studies have concluded that the VAT reform can bring all industries into the scope of collection to the maximum extent, which is helpful to improve the deduction chain of VAT and eliminate the phenomenon of double taxation. Guo and Lu[1] believed that tax would have an impact on input of factors of production, and thus income distribution of factors of production. Taking VAT transformation as an example, the larger the scope of deduction of fixed assets of VAT means the smaller the scope of taxation on output. Fan Yong[2] believes that the differences in VAT systems are mainly reflected in the differences in deduction systems, and the reform to expand the scope of VAT deduction is conducive to narrowing the tax burden differences among industries. Combined with the "natural experiment" event of VAT transformation studied in this paper, relevant scholars made extensive analysis from the aspects of industrial structure, regional structure, consumption structure and enterprise nature,[3] but this paper mainly focuses on the study of the impact of reform on factor input.

In relation to the impact on investments from VAT reforms, theoretical research has been done by Zhu, who noted a positive correlation between VAT reforms and an increasing assets investment through analysis of investment subject, length, extent, and cash flows alongside various evaluative indexes.[4] Also, via a theoretical approach, Cai has examined the application of the Net Present Value (NPV) methodology to analyse the impacts of VAT reforms. They both have found significant evidence in the reform's influence to enable greater investment feasibility

[1] Please see, 郭庆旺, 吕冰洋,《论税收对要素收入分配的影响》, Guo Q & Lv B, 'The Influence of Tax on Factor Income Distribution', (2011) *Economic Research Journal* 6 , at 16-30; 郭庆旺、吕冰洋,《论要素收入分配对居民收入分配的影响》, Guo Q & Lv B, 'The Influence of Factor Income Distribution on resident income distribution', (2012) *Chinese Social Sciences* 12, at 46-62.

[2] 樊勇, 《增值税抵扣制度对行业增值税税负影响的实证研究》, Fan Y, 'An Empirical Analysis on Impact of the Extending of VIT Deduction Scope on Sector's Tax Burden', (2012) *Finance & Trade Economics* 1, at 34-41.

[3] Please see, 杨斌, 龙新民, 李成, 尹利君, 《东北地区部分行业增值税转型的效应分析》, Yang B, Long X, Li C & Yin L, 'Impact Analysis of VAT Reforms Upon Certain Industries in Northeast China' (2005) *International Taxation in China* 6, at 9-15; and 程瑶, 陆新葵, 《增值税转型对经济结构影响的实证分析》, Cheng Y & Lu X, 'The Positive Analysis on Influence of the Added Value Tax Transformation to the Economy Structure', (2006) *Journal of Central University of Finance & Economics* 9, at 11-14.

[4] 朱娟, 《增值税转型对企业固定资产投资决策的影响》, Zhu J, 'Impact of VAT Reforms upon Firms' Decisions on Fixed Asset Investments' (2009) *Research of Finance and Accounting* 2, at 17-18.

– particularly as the NPV for consumption VAT were found to be consistently greater than the NPV for the investment of production.[5] Undertaking empirical research, Li and Li applied multivariate regression models to analyse micro-level business data of 8 different industries in Northeast China. Positive feedback cycles of investment and growth as contextualised by the decreasing corporate tax burden following the VAT reforms were reported but remained notably absent in petrochemical nor technological industries.[6] Finally, within Lu and Xu's analysis of 2003-2009 data from A-grade stocks in Shenzhen and Shanghai stock markets, similar trends had been observed – noting the influence of VAT reforms in stimulating corporate investments into assets. However, alongside the reforms' direct, concrete impacts, the industry's expected policy ramifications resulted in the short-term delay of investments in the months prior to the reform's announcement also contributed to the findings observed. This is particularly contextualised by the 2008 financial crisis and changes to governmental credit policies and contribute as confounding factors.

Secondly, from the perspective of the impact of VAT reform on labour force (including employment rate and wage level), Duttal et al.,[7] Boeters et al.,[8] Michaelis and Birk[9] investigated the changes in labour demand when the actual income tax rate and capital tax rate faced by enterprises changed. Hutton and Ruocco[10]. analysed the reaction of the whole labour market to the tax rate change from a more macroscopic perspective. In addition, there are also considerable literatures abroad that use the double difference model to analyse the correlation between tax system and labour force. For example, Eissa[11] and Feldstein[12] respectively analysed the impact of 1986 income tax reform on labour supply of different groups in the United States. Chinese scholars' research on the impact of VAT reform on labour force is basically carried out at the level of enterprises and industries, but the research conclusions are not consistent. Some scholars believe that the VAT transformation has a positive effect on labour employment, that is, the transformation promotes the employment behaviour of enterprises. Liu and Yuan used the panel data of more than 40,000 enterprises in the three provinces of northeast China from 2000 to 2007 and used the double difference method to find that the reform significantly improved the employment of labour force in pilot enterprises, without increasing fixed assets and

[5] 蔡昌, 《增值税转型后的税负变化及其影响》, Cai C, 'The Changing Tax Burdens and its Implications Following the VAT Reforms', (2009) *Taxation Research* 5, at 55-57.
[6] 李嘉明, 李苏娅, 《增值税转型对企业固定资产投资影响的实证研究》, Li J & Li S, 'The Empirical Analysis of the Value-added Tax Transformation on Fixed Assets Investment of Corporations', (2007) *Collected Essays on Finance and Economics* 1, at 26-31.
[7] Duttal B, Gang IN & Gangopadhyay S, 'Subsidy Policies with Capital Accumulation: Maintaining Employment Levels.', (1989) *Journal of population economics* 2(4), at 301-318.
[8] Please see, Boeters S, Böhringer C, Büttner T & Kraus M, 'Economic Effects of VAT Reforms in Germany.' (2010) *Applied Economics* 42(17), at 2165-2182; and Böhringer C, Boeters S & Michael F, 'Taxation and unemployment: an applied general equilibrium approach.' (2005) *Economic Modelling* 22(1), at 81-108.
[9] Michaelis J and Birk A, 'Employment and Growth Effects of Tax Reforms.' (2006) *Economic Modelling* 23 (6), at 909-925.
[10] Hutton JP & Ruocco A, 'Tax Reform and Employment In Europe.' (1999) *International Tax and Public Finance* 6(3), at 263-287.
[11] Eissa N, 'Taxation and Labour Supply of Married Women: The Tax Reform Act of 1986 As A Natural Experiment.' (1995) *National Bureau of Economic Research*, No. w5023.
[12] Feldstein M, 'The effect of marginal tax rates on taxable income: a panel study of the 1986 Tax Reform Act.' (1995) *Journal of Political Economy* 103(3), at 551-572;

reducing labour force.[13] However, they also stated that this conclusion was only limited to heavy industry. More scholars believe that the VAT transformation has a negative impact on labour employment. Nie Huihua et al. used the panel double difference model to control the enterprise scale and profit margin and found that the VAT transformation significantly reduced the number of employees, with an average reduction of about 10%.[14] Chen Ye et al. set up a macro closed CGE model under the conditions of Keynes and surplus labour, simulated and considered the policy effect of VAT transformation on national employment rate, and found that 4.44 million people may be newly unemployed. [15]

Lastly, we look at the comprehensive effect of VAT reform on investment and employment from the perspective of "capital replacing labour". "Capital instead of labour" can be regarded as VAT a negative impact on employment, the inner mechanism of the transformation will distort relative prices of capital and labour, similar to relax the opportunity cost of capital constraint, the enterprises use encouraged companies to use more capital to replace labour, thereby change the ratio of enterprise production factors, the effect is similar to "forge - Johnson o effect". [16] As whilst production-oriented VAT could be considered 'neutral' according to Lindholm's definition[17] – having been empirically verified through Zhang and Chen's research using the United Nations System of National Accounts' (UNSCA) methodologies,[18] the same could not be said about consumption-oriented VAT levies. Rather, with such characteristics like a lack of taxation on capital investments in favour of a greater levies on labour factors will change the "capital user cost", thereby impacting capital and labour elasticity and fundamentally distorting the prices of factors and hence altering investment structures of enterprises'' production factors.[19] In analysing the data from China's heavy industry sector between 1999-2005, whilst Nie verified the existence of this 'capital labour substitution' to substantiate a conclusion of increasing efficiency consequent on VAT reforms,[20] Chen also demonstrated the negative implications of this by taking into account China's unique circumstances, the status quo of the factor market, and a macroeconomic outlook – to arrive at a counterpoint conclusion in the decline in

[13] 刘璟, 袁诚, 《增值税转型改变了企业的雇佣行为吗？——对东北增值税转型试点的经验分析》, Liu J & Yuan C, 'Has the VAT Reforms Changed the Firms' Employment Behaviours? An Empirical Analysis of the Northeast VAT Reform Trials' (2012) *Economic Science* 1, at 103-114.

[14] 聂辉华, 方明月, 李涛, 《增值税转型对企业行为和绩效的影响——以东北地区为例》, Nie H, Fang M & Li T, 'Impact of VAT Reforms on Firms' Behaviour and Achievements – Example from North-eastern China' (2009) *Management World* 5, at 17-24.

[15] 陈烨, 张欣, 寇恩惠, 刘明, 《增值税转型对就业负面影响的 CGE 模拟分析》, Chen Y, Zhang X, Kou E & Liu M, 'VAT Tax Reform and Its Negative Impact on Employment in China: A CGE Analysis', (2010) *Economic Research Journal* 9, at 29-42.

[16] Averch H & Johnson LL, 'Behaviour of The Firm Under Regulatory Constraint', (1962) *The American Economic Review* 52(5), at 1052-1069.

[17] Lindholm RW, 'The Value Added Tax: A Short Review of The Literature.' (1970) *Journal of Economic Literature* 8(4), at1178-1189.

[18] 张欣, 陈烨, 《增值税理论探讨：为什么说生产型增值税是中性的》, Zhang X & Chen Y, 'Inquiry into VAT Theory: Reasons for the Neutrality of Production-Based VAT' (2009) *Public Finance Research* 4, at 50-57.

[19]Jorgenson DW, 'Capital Theory and Investment Behavior.' (1963) *The American Economic Review* 53(2), at 247-259; Jorgenson DW & Kun-Young Y, 'Taxation, efficiency and economic growth', Handbook of Computable General Equilibrium Modeling. *Elsevier* 1, at 659-741; and Chirinko RS, 'Corporate taxation, capital formation, and the substitution elasticity between labour and capital.', (2002) *National Tax Journal* 55(2), at 339-355.

[20] Above note 14.

labour demand by ¥6390 million RMB (roughly equivalent to a loss of 4.44 million positions).

Reviewing the existing literature on the evaluation of the economic effect of VAT reform, we find that there are mainly the following five deficiencies :(1) more qualitative research, less quantitative research;(2) The data range is small, and most of them only study a certain region without considering from the national level;(3) It usually only studies the unilateral influence on investment and employment, ignores the influence on wages, and fails to consider the linkage of all factors;(4) The measurement methods are relatively monotonous and are mostly simple multiple regression;(5) It does not reveal the intertemporal differences of different effects in the short and long term. This paper will try to make a breakthrough and expand from the above five aspects to further enrich and improve the research results of VAT.

III. Two Firm Theoretical Models

To simplify the analysis, two types of firm theoretical models have been constructed. These are underlaid by several assumptions. First, there are only two types of manufacturers within a region; with one benefiting from the VAT reform (referred hereafter as the 'beneficiary manufacturer') to be symbolised by the subscripted 'x', with a total of n_x branches. The other type of manufacturer would bear no relation to the VAT reform and would be unaffected by it (hereafter known as the 'unaffected manufacturer'), symbolised by the subscripted 'y', and with these manufacturers having a total of n_y branches in the region.[21] Second, regional availability of both labour and capital inputs is limited overall. The total extent of available labour is represented by $\bar{L}$, and the total extent of capital being limited by $\bar{K}$. Third, free movement of labour and capital can be observed, with the two types of manufacturers able to freely allocate their factors of production – with the decision-making influenced by market conditions and factor costs. Fourth, the two types of manufacturers would have the same extent of manufacturing technology, with their production functions also satisfying the Cobb-Douglas production function: $q = AF(K, L)$. This means their production adheres to a constant scale, implicitly conforming to the characteristics of Hicks' neutral technical progress. The following variables are further defined: product prices as *P*, output (sales figures) as *q*, capital input as *K*, labour inputs as *L*, interest rates as *r*, and profits as π. Based upon above assumptions and definitions, the respective production functions of the two models could be then ascertained; being respectively:

$$\begin{cases} q_x = AF^x(K_x, L_x) \\ q_y = AF^y(K_y, L_y) \end{cases} \quad (1)$$

21 Differing from the 'Business to VAT' reforms fundamentally changing the tax regime for businesses, the prior changes have rather only encompassed alternations to the existing scope of the VAT, also catalysing a greater scope of deductions being available to businesses formerly outside of the VAT system. In cases of expansions, the firms' VAT obligations would decrease, in benefit to business operations. Such, as no detriment would be caused to any firms because of changes; the categorisations of firms here would hereby be limited to only 'beneficiary' and 'anti-associated' firms.

Considering the manufacturers' differences with regards to product prices, capital investments, labour costs, differences in interest rates and wage disparities between the two types of manufacturers; the factor demand function could then be resolved as:

$$\begin{cases} L_x^d = L_x(\frac{P_L}{P_x}, \frac{P_K}{P_x}) \\ L_y^d = L_y(\frac{P_L}{P_y}, \frac{P_K}{P_y}) \\ K_x^d = K_x(\frac{P_L}{P_x}, \frac{P_K}{P_x}) \\ K_y^d = K_y(\frac{P_L}{P_x}, \frac{P_K}{P_x}) \end{cases} \quad (2)$$

Next, in accordance with functions (1) and (2), at the point of equilibrium of the two manufacturers in relation to their respective sales and production, the profit function would be:

$$\begin{cases} \pi_x = P_x q_x - P_L L_x - P_K K_x \\ \pi_y = P_y q_y - P_L L_y - P_K K_y \end{cases} \quad (3)$$

The Edgeworth Boxplot describes the possibilities for the distribution of respective factors of production in the manufacturing of two differing product outputs, thus demonstrating market equilibrium. This, in conjunction with the above assumptions underlying the two manufacturer-based models define the restrictions to the factor of productions' availability as:

$$\begin{cases} n_x \times L_x^d + n_y \times L_y^d = \bar{L} \\ n_x \times K_x^d + n_y \times K_y^d = \bar{K} \end{cases} \quad (4)$$

Next, granted the assumption of limited regional availability of labour and capital, and the existence of a free movement of capital between both types of manufacturers, one can conclude at the point of market equilibrium that they would face the same factor prices. This could be expressed through $P_L = w$ and $P_K = r$; with *w* being wage levels and *r* being capital use. Then, through the construction of a Lagrange function, the maximisation of profits could be attained for both types of manufacturers as the optimal extent of labour intensity per unit of investment at the point of market equilibrium.

$$\frac{P_L}{P_K} = \frac{MP_L^x}{MP_K^x} = \frac{MP_L^y}{MP_K^y} = \frac{w}{r} \quad (5)$$

Function (5) illustrates that the labour intensity of unit capital input is directly proportional to the cost of capital use and inversely proportional to the wage rate. This indicates as the cost of capital use increases, manufacturers tend to increase labour intensity, and increased wage rate is accompanied by labour cost increases, prompting increase capital investment. This exemplifies the trade-off in cash cost and opportunity cost of different schemes when making decisions on capital-labour combinations. For beneficiary manufacturers after the VAT reform, their newly

purchased fixed assets can be deducted for input, so the opportunity cost is greatly reduced, thus making the ratio of labour-capital factor price (denoted as w/r) a relatively increasing trend.

Under the assumption of free movement of capital in the region, further capital investments (*K*) would be necessary for beneficiary manufacturers to maximise profits should let the labour inputs remain unchanged, subsequently reducing MP_K. However, manufacturers need to expand their scale of production, marked by greater utilisation of labour inputs, their extent of capital utilisation also must increase at greater rate to maximisation profitability. This would be reflected in the increasing to MP_L/MP_K and corresponded in the decreasing to the labour-capital (*L/K*) ratio.

Thus, at a point of market equilibrium for both manufacturer types, the condition of profit maximisation will lead to the unconditional demand function of factor inputs being equal to the cost-conditional demand function. It would such satisfy the below equation:

$$u(P_x,\ P_y,\ w,\ r) = u^c(w,\ r,\ q_x,\ q_y) \qquad (6)$$

Moreover, supposing the capital market conditions faced by beneficiary and unaffected manufacturers to be equal in terms of interest rates (differing only in terms of policy influence under VAT reforms), a shift in manufacturer-based decision-making could be observed. This is granted there is cost reduction for beneficiary manufacturers in relations to asset purchases. This, deriving *r* in function (6) would lead to the equation below:

$$\frac{\partial\left(u(P_x,\ P_y,\ w,\ r)\right)}{\partial r} = \frac{\partial\left(u^c(w,\ r,\ q_x,\ q_y)\right)}{\partial r} + \frac{\partial\left(u^c(w,\ r,\ q_x,\ q_y)\right)}{\partial(q_x,\ q_y)}\frac{\partial(q_x,\ q_y)}{\partial r} \qquad (7)$$

The first term of right-hand side of function (7) represents of the 'capital labour substitution' granted changes in asset purchase costs. The second term representation of the effect of output.

Considering the long-term industry effect on volume of production, if no restriction on expenditure is experienced, then it will not equal 0 – overall making the $\frac{\partial\left(u(P_x,\ P_y,\ w,\ r)\right)}{\partial r}$ variable uncertain. In the short-term, market demand of enterprises experiences limited fluctuations, and thus production amount will generally not change. Temporarily, via substitution the production effect limits to 0 – thus $\frac{\partial\left(u(P_x,\ P_y,\ w,\ r)\right)}{\partial r} < 0$. As to the two manufacturer types faces differing problems for its appreciating assets, the restrictions on funds each encounter are also distinct. Thus, within a set period, short and long-term effect appears mixed overall. More specifically, relying mainly on the short-term substitution effect, the long-term effect will return to equilibrium status and the overall fluctuation range will decrease.

According to Gerber's wage determination theory, the primary factors influencing wage levels include: the respective bargaining powers of the labour force and corporations (as influenced by variables of union intervention and transactional costs), the human capital (including workers' education levels) and other

determinants including worker morale, wage schedules, and the existing institutional regime.[22] Resultingly, whilst local wage schedules and regional costs of labour may remain largely stable, VAT reforms has potential implications in altering departmental hires in various sectors alongside an increase in capital investment may ultimately lead to structural shifts in labour demand. This would hence cause an increasing disparity in bargaining power between workers and corporations, altering the existing, observable equilibrium present in the supply/demand within the labour market at large. For beneficiary manufacturers, this would internally reconstitute the labour force composition. With demand for workers increasing in technologically irreplaceable roles, a consequential rise in average wage levels will also signal layoffs for lower skilled workers. Contrastingly, such layoffs will increase the competitiveness of the labour market and the supply of labour. Decreasing wage levels within their future roles (likely within unaffected manufacturers) seems a possible conjecture. Hence within this duality of theoretical implications, the net impacts of the VAT reforms to regional average wage levels fail to be theoretically attained.

In mirroring further VAT reforms, an augmentation of enterprise tax deductibles for assets and services expenditure will expand both investments and employment. Nonetheless, when indirect impacts are closely considered, implications of 'capital labour substitution' and the structural alterations in the factors of production will see divergent choices between capital and labour deployment resulting in its reciprocal rise and fall. Disregarding the rachet effect, wage levels could be interpreted as inversely proportional to employment demand. Thus, the implications of VAT reforms upon investment, employment, and wages are inadequately construed as a theoretical question. Rather, empirical analysis, dependent upon location and temporal scope will elucidate clearer trends and conclusions.

[22] Gerber N, *Biodiversity measurement, species interactions and sustainability*, (University of New South Wales, 2006).

IV. Regression model and data

4.1 Regression model

Through a context of regional economic entities, policy changes (such as VAT reforms) could be viewed as exogenous events, characterising its observation through the lens of a 'natural experiment'. This fuses a common evaluative policy approach with the methodology of DID analysis. This would involve the categorisation of the selected 'natural experiment' sample into 'experimental' and 'control' groups, before calculating, analysing, and comparing the respective groups for disparities in outcomes in evaluation of policy impacts.[23] (For economic entities in different regions, policy changes can be regarded as an exogenous event, so this paper regards the VAT transformation reform as a "Natural Experiment" .In the existing research, the double difference method is more common to evaluate the effect of "natural experiment" policy. The selected samples were divided into a treatment group and a control group according to a certain standard, and then the result changes (difference values) caused by policy changes were calculated, analysed and compared in the two sample groups respectively, so as to evaluate the effect of policy and institutional changes.)In this paper, with a focus in examining whether the VAT reforms have empirically altered the variables of the extent state-wide fixed investments, employment, and average wage levels; the regression function could be expressed as follows:

$$Y_{it} = \beta_0 + \beta_1 invo_t * dist_i + X + \alpha_i + \alpha_t + \mu_{it}$$

Within the function, Y_{it} could be the predicted variable; encompassing the prefecture-level city's (i) fixed asset investment as a fraction of GDP within a certain year (t), the unit number of employments as a portion of total population, and the average wage levels of those employed.

$invo_t$ ('time since reform') is a dummy variable differentiating areas before and after VAT reforms ($invo_t$ =1 if the prefecture-level city has undergone reform during that year or in years prior). Similarly, $dist_i$ ('region involved in reforms') is another dummy variable; in differentiation of the regions involved in the reforms as opposed to the regions uninvolved (the variable would only be valued 1 instead of 0 if the regions are involved with the reforms).

[23] With reference to the application of the DID model, please see Bertrand M, Esther D & Mullainathan S, 'How Much Should We Trust Differences-In-Differences Estimates?', (2004) *The Quarterly journal of economics* 119(1), at 249-275; Athey S & Imbens GW, 'Identification and Inference in Nonlinear Difference-in-Differences Models.', (2006) *Econometrica* 74(2), at 431-497; 周黎安，陈烨，中国农村税费改革的政策效果:基于双重差分模型的估计, Zhou L & Chen Y, 'Policy Effects of Rural Tax and Fee Reform in China: An Estimation Based on The Dual Difference Model', (2005) *Economic Research* 8, at 44-53; 王跃堂，王亮亮，彭洋，《产权性质、债务税盾与资本结构》, Wang Y, Wang L & Peng Y, 'Ownership Nature of Ultimate Controller, Debt-related Tax Shields and Capital Structure' (2010) 9 Economic Research Journal 122-136; and 樊勇, 王蔚, 《"扩权强县"改革效果的比较研究——以浙江省县政扩权为样本》, Fan Y & Wang W, 'The Contrast Research between Developed and Developing Counties under the Strengthening County Reform: Based on Zhejiang County Panel Date', (2013) *Journal of Public Management* 1, at 10-18.

Additionally, X is a control variable encompassing various factors including economic performance (regional, per-capita GDP), industry structure (extent of non-agricultural industries within the economy), governmental size (percentage of government expenditure as a proportion of GDP). It also accounts for capital and labour intensity (through density of non-agricultural employment per square kilometre) and the regional human capital at hand (encapsulated through the variable of the extent of enrolled students in high school and above per 10,000 people).

Finally, individual traits unquantifiable between regions is denoted by the α_i variable, and the variations in economic cycles represented by α_t (using 2002 as the baseline, with 8 dummy variables for each following year). Random error is captured by μ_{it}.

In the above equation, the cross-term dummy variables $invo_t$ and $dist_i$ would be the core explanatory variable of the double difference model and is also the focus of the estimation results. The coefficient before the cross term is equal to the difference between the 'control group' minus the change's observable to the 'test group' within contemporaneous periods, hence providing the 'net impact' of the VAT reforms.

4.2 Explanation of data

With this paper's aim and the attainability of statistics related to the VAT reforms and its progression overall, a sampled interval between 2002-2010 had been selected. The data used includes regional GDP values, average wage levels, unit employment numbers, regional asset investment values and others. They have been sourced from the National Bureau of Statistics and the 283 available databases of annual, prefecture-level cities. However, due to the significant missing data for Xinjiang, Tibet, and other regions as well as a need for consistency, certain cities have been excluded. This lead only 255 cities being included[24] with 2295 figures available for analysis. To also account for annual economic variation, the absolute values of regional GDP, asset investment values, and average wage levels have been modified with reference to the Consumer Price Index, using 2001's data as the baseline.

The dependent variables have been construed with the paper's primary objective in mind, being the analysis of VAT reform's influence on the factor inputs of capital and labour (including labour quality and earning level). Firstly, to understanding its impact to regional investment input levels, the value of state-level asset investments in relations to regional GDP had been established as the first dependent variable. Then, in observing its effects to levels of regional employment rates, the second dependent variable denoted the total unit employment of society as a percentage of total population. Implications of the reform towards worker pay placed regional average worker income as the third dependent variable. Finally, 8 yearly dummy

[24] Due to data deficiencies, a total of 28 prefecture-level cities have been excluded from the study, namely: Hengshui in Hebei; Lüliang in Shanxi; Bayannur and Ulanqab in Inner Mongolia; Ji'an in Jiangxi; Xiangyang in Hubei; Hechi, Hezhou, Baise, Laibin, Guigang, Yulin, Chongzuo, Qinzhou, Fangchenggang and Beihai in Guangxi Zhuang Autonomous Region; Yunnan, Lincang and Pu'er in Lijiang; Lhasa in Tibet; Jiuquan, Zhangye, Qingyang, Pingliang, Dingxi and Longnan in Gansu; and, Ningxia and Guyuan in Zhongwei. Amongst these, Xiangyang city in the Hubei province had been a pilot city for VAT reforms in 2007, whereas the others have simply become fully reformed cities during 2009.

variables have also been added, in modelling the changes from transitioning economic cycles.[25]

In ascertaining the 'net effects' of VAT reform within the scheme's pilot regions, separate dummy variables identify both 'time since reform' and regions with/without such implementation, such that the cross term would serve as the regression model's core dependent variable as aforementioned.

The 'year of the reform' would be defined as the first year in which the reform has taken place, such that the "i^{th} year of reform" could be considered i^{th} year (inclusive of the year of the reform). For cases such as 2004, 2007, and 2008 when the VAT reform had been conducted during July and August; the statistics from these years would anecdotally reflect the reform's influences and the status quo prior to the reforms. However, as VAT settlement calculations usually continue until the end of the year, it would be unlikely for the manufacturer to immediately respond to regulatory changes by shifting their investment, recruitment, and employee wage levels.[26] Contextualised by this understanding, 2005, 2008, and 2009 respectively would instead be denoted as the beginning of the 3 pilot programs. For 2009, as January 1st was when the national VAT reforms were announced, thus treated as when the VAT reforms began for all other regions.

For the dummy variable 'regions involved in reforms', the variable would be valued at 1 only on, or after the advent of the reform. Specifically, for all regions before the first pilot program in 2005, the variable for all samples would be 0. During the first pilot program between 2005-2007, only three Northeast Provinces involved is recorded as 1. Similarly, within the second pilot period, only the 26 industrial cities in Central China alongside the Northeast Provinces would be recorded as 1.

Lastly, by reference to existing research methodologies, the control variables have been set in this paper as follows. It encompasses: (1) Regional economic base (represented by local GDP per capita) reflecting the local economy's and potential extent of future taxation; (2) Industry structure (percentage of GDP for non-agricultural industries within the local area), for comparisons across regions; (3) Government intervention (extent of government expenditure to local GDP) account for efficiency of economic intervention contextualised by 'Yardstick Competition'; (4) Density of labour employment (density of non-agricultural employment per square kilometre) to implying a region's density of economic activity and overall market size,[27] and (5) Human capital, (number of enrolled students beyond primary

[25] Each region's fixed asset investment amount included a significant portion of investment in property development. However, combining *Provisional Regulations of the PRC on Value-Added Tax* and *Provisional Regulations of the People's Republic of China on Business Tax*, it has been ascertained that property development is not yet within the scope of VAT collection. However, as the impact of VAT reform on property investment is relatively small, this paper would thus entirely exclude property development investments from the fixed assets data referenced.

[26] Above note 14.

[27] Ciccone A, *Dynamic Externalities and the Spatial Distribution of Wages in the US*, (University of Berkeley, 1997); Fan JY, 'Industrial Agglomeration and Difference of Regional Labour Productivity: Chinese Evidence with International Comparison.', (2006) *Economic Research Journal* 11, at 72-81.

education per 10,000 people) with the data sourced from Liu & Yin[28] and Shen & Geng.[29] Other possible methods include references to local education budgets, average years of education undertaken, and application of the Physical Quality of Life Index (PQLI).[30]

These control variables are employed as applicable. Thus, only regional economic base, industry structure, and government intervention would be used in analysing the impact of VAT reforms to overall investment inputs. The variables of density of labour employment and human capital is rather applied in analysis of implications to employment rates and wage levels.

4.3 Summative Statistics of Variables

Table 1 (below) summarises the statistical traits of the variables in the regression model. From the table, China's investment intensity has overall appeared relatively high, accounting for an average of 52.86% of its GDP. This reflects China's economic growth and development as foundationally 'investment driven'. Additionally, with significant disparity in min/max values of employment and wage levels, potential inequalities in employment prospects and prospective earnings between different regions in China can also be gleamed. With regards to the time and region dummy variables, 29% and 24% of locations sampled have begun trialled reform earlier than others by reference to geography and time. The sample size is demonstrably large as a result. Besides, as the control variables of regional economic base, industrial structure, government intervention, density of labour employment and human capital reveal, differences between regions of China can be also observed in the standard deviation and min/max differential of each variable.

[28] Liu XY & Yin XM, 'Spatial externalities and regional wage differences: A dynamic panel-data study.', (2008) *China Economic Quarterly* 8(1), 77-98.
[29] 沈坤荣，耿强，《外国直接投资、技术外溢与内生经济增长——中国数据的计量检验与实证分析》 Shen KR & Geng Q, 'Foreign Direct Investment, Technology Spill over and Endogenous Economic Growth: A Quantitative Test and empirical Analysis of China's Data', (2001) *Chinese Social Sciences* 5, at 82-93, 206.
[30] Morris JS, *Real Estate Tax Planning*, (Little Brown, 1977).

Table 1: Summative Statistics of Variables (2002-2010)

	Sample Size	Average	Min Value	Max. Value	Standard Deviation
Investment Intensity (%)	2295	52.86	4.04	93.08	0.27
Weighting of Labour Inputs as a Factor of Production (%)	2295	17.51	1.21	97.36	0.10
Wage Levels (10,000 RMB annually)	2295	1.82	0.18	14.11	0.75
Indicator Variable for Areas of Reforms	2295	0.24	0	1	0.43
Indicator Variable for Time of Reform	2295	0.29	0	1	0.45
Per capita GDP (10,000 RMB annually)	2295	2.88	0.12	24.90	2.19
Portion of Non-agricultural Industries to Local Economy (%)	2295	92.55	39.54	99.93	0.08
Government Expenditure to Local Economy (%)	2295	11.90	1.51	64.88	5.64
Employment Density (10,000 people per km^2)	2295	0.02	0.00	1.02	0.03
Human Capital – Extent of High School Enrolments and Above (%)	2295	0.38	0.00	2.31	0.00

V. Empirical evidence and analysis

5.1 Regression Results

5.1.1 Investment Intensity

Governmental changes in extrinsic, macroeconomic policies inherently impact upon economic actors from a microeconomic perspective and their resulting business decisions. Granted this extrinsic nature of policy, a methodology of statistical testing derived from "natural experiments' can similarly assess by comparison of its economic status before/after the VAT reforms its influence upon the same geographical region. Particularly, this could be done in considering its effects on overall asset investment.

The results of this are explicated in Table 2. Within the table, models (1) & (2) only consider the dummy variable of 'time since reforms', and models (3) & (4) solely analyses with respect to 'region involved in reforms. Models (5) & (6) considers both variables together, using two derived cross terms distilling analysing of effect of the reform through the DID methodology.

Observing the results, models (1) & (2) indicates that for 'time since reform', no matter whether controls are established for the economic cycle, the extents of investment for all regions are still higher following the reforms (to 10% significance level). This shows a positive, stimulatory correlation between the VAT and increasing regional investment, potentially spurred by the increased scope of tax deductions.

As shown in the results from models (3) & (4), post-reform regions from the same period failed to observe greater extents of investment than pre-reform counterparts. However, this may be simply due to geographical variations in a regions' development, as the post-reform locations analysed have generally been from the less developed Northeast and Central China regions, with comparatively lower extents of investment and accumulated savings overall. This result suggests that

these regions' existing structural deficiencies were not totally mitigated through short term policy stimulus (such as through the VAT reforms.

Despite this, the cross term as modelled by (5) & (6) show an overall positive effect from VAT reforms (at 1% significance level). After controlling other variables affecting investment, the investment intensity after the VAT reform still increased significantly, exemplifying an intended shift from production-oriented VAT levies towards one that is increasingly consumption-oriented.

Next, an examination of the impact of various control variables on regional investment is conducted through regression, bearing in mind China's controlled economic cycle. Firstly, 'regional economic base' has provided positive correlation with increased investment (at 1% significance level). It illustrates that compared to underdeveloped regions, the economic growth model of the developed regions maintains healthier and more substantial momentum. Instead of being simply driven by investments, developed regions have rather (to an extent) already transitioned to a consumption-based foundation for growth. Secondly, the impact of 'industry structure' to investment intensity has also been significantly positive (at 5% significance level), indicating that compared with agriculture, development of non-agricultural industries requires more funds. This phenomenon can be particularly observed in enterprise transformations, with their subsequent needs for capital intensifying investment overall. Thirdly, government intervention also seen a similar positive correlation (to a 1% significance level). This may be due to China's provisions of government expenditure, and its significant focus upon construction and infrastructural investments as opposed to public services overall. Therefore, the scale of government fiscal expenditure will significantly affect the local investment intensity.

Lastly, from a viewpoint of the economic cycle, as compared to 2002, the investment intensities of all regions during 2003-2010 have all observed a continued rising trend, this to a 1% significance level. Particularly, in comparisons between yearly figures, the 2009 investment intensities have experienced the most significant increase of all the years analysed. This may be a result of government intervention in face of the 2008 Global Financial Crisis, leading to an elevation in investment intensity nationally, particularly as characterized by the Central Government's stimulus package of 4 trillion dollars overall.

Finally, in considering the change within the economic cycles (compared with 2002), the investment intensity of various regions from 2003 to 2010 has shown a consistent annual upward trend (all significant at the 1% level). By comparing the difference in coefficient values between adjacent years, it was evident 2009 had the largest increase. This may be attributed to related to the four trillion-dollar investment stimulus introduced by the Chinese central government in order to alleviate the impact of the global financial crisis in 2008. The huge capital investment has significantly boosted the level of investment intensity in the region.

Table 2: Regression Model of the Impacts of VAT Reforms Towards Investment Intensities (DID Methodology)

	(1)	(2)	(3)	(4)	(5)	(6)
'Time Since Reform' (Indicator Variable)	0.16***	0.03*			0.14***	-0.04*
	(14.33)	(1.89)			(11.72)	(1.92)
'Region Involved in Reforms' (Indicator Variable)			-0.05**	-0.02	-0.11***	-0.06**
			(2.04)	(0.70)	(4.10)	(2.39)
Time Since Reform * Region Involved in Reforms					0.05***	0.11***
					(2.95)	(5.36)
Regional Economic Basis	0.01***	-0.02***	0.04***	-0.02***	0.01***	-0.02***
	(3.76)	(4.69)	(12.44)	(5.40)	(3.33)	(5.95)
Industry Structure	0.30**	0.42**	0.30**	0.23**	0.40***	0.31***
	(2.52)	(2.47)	(2.47)	(1.99)	(3.33)	(2.69)
Governmental Intervention	1.69***	1.29***	2.33***	1.18***	1.71***	1.16***
	(15.52)	(10.46)	(22.89)	(10.58)	(15.78)	(10.48)
2003		0.10***		0.10***		0.10***
2004		0.13***		0.13***		0.13***
2005		0.16***		0.16***		0.15***
2006		0.19***		0.19***		0.19***
2007		0.22***		0.23***		0.23***
2008		0.25***		0.27***		0.25***
2009		0.33***		0.37***		0.39***
2010		0.38***		0.42***		0.45***
Constant Term	-0.03	-0.17	-0.12	0.03	-0.10	-0.03
	(0.26)	(1.01)	(1.07)	(0.28)	(0.90)	(0.28)
Adj-R^2	0.3185	0.6285	0.2578	0.4019	0.3239	0.4099
Number of Analysed Regions	255	255	255	255	255	255
Sample Size	2295	2295	2295	2295	2295	2295

Note: the absolute t-values are in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% respectively

5.1.2 Employment Rate

Analogous to the above results and methodology, one could also similarly ascertain the net impacts of the VAT reforms towards employment rate for the same distinguishing factors. The results of this are listed in Table 3.

As such, all the models outlined in Table 3 relate to the same variables as Table 2. However, two additional influential variables have also been added for consideration; namely that of 'Density of Labour Employment' and 'Human Capital'.

In observing the results of Table 3, models (1) & (2) illustrate a significant correlation could be seen with the VAT reforms increasing unemployment, regardless if the economic cycle is considered. This indicates that with manufacturers limited in expenditure, they are more likely to reallocate their spending towards tax deductible asset investments, directly catalysing reductions and layoffs in the workforce to compensate and maximise capital overall. By observing the results in models (3) & (4), a theorised increase in 'capital labour substitution' has not meaningfully materialised overall. Rather with the increasing development of Northeast and Central China through the VAT reforms catalysing greater opportunity, there has been an increasing influx of workers from the Eastern provinces, particularly when there is a relative saturation in labour force demand from those more developed areas. This is also bolstered by governmental policies

for the 'Revitalisation of the Northeast' and the 'Rise of Central China'. However, model (5) & (6) contends that through evaluating the interactions of the two geographical and temporal variables, a significant negative correlation of the VAT reforms towards employment rate is still observed (to a 1% significance level). This implies that whilst a restructuring of the factors of production has already materialised, it has led to an increasing demand of high-skilled labour, thereby indirectly lowering the demand for unskilled labour and their temporary unemployment.

As the goodness of fit under a controlled business cycle is higher that it under uncontrolled conditions, a consideration of those controlled variables is meaningful. First, there is a significant positive correlation between the regional economic base and employment rate (to a significance level of 1%). This is particularly prevalent in Eastern provinces, as a large need for exports requires a sizeable labour force to fulfil such economic demand. Secondly, as non-agricultural industries all require more labour inputs compared to agricultural industries, the increasing existence of the former would also correlate with increasing job opportunities (to a 1% significance level).

Thirdly, government intervention has an observable but insignificant impact on employment rate, potentially depicting how governmental priorities lean more towards infrastructure development as opposed to a structural education/adjustment of the workforce to mirror firm-based demands. Fourthly, increasing employment density correlated with the increasing enterprise employment of labour as a factor of production, indicating that is may relate to population density as well. Fifthly, conceding with the positive correlation with human capital on investment, its influence on greater employment may suggest that regions with better educated individuals would experience higher employment rates overall. This hints at a future government direction to focus and prioritise upon.

Finally, a comparison of the economic cycle, uncontroversially illustrates that employment rate in various parts of China has been increasingly declining as a longstanding trend since 2002. This could reflect the rising concern of an aging Chinese population, and a reduction in the scale of the overall labour force but could also show an increasing detachment between graduates and their integration into the workforce through businesses.

Table 3: Regression Model of the Impacts of VAT Reforms Towards Employment Rates (DID Methodology)

	(1)	(2)	(3)	(4)	(5)	(6)
'Time Since Reform' (Indicator Variable)	-0.01***	-0.01*			-0.01***	0.00
	(3.18)	(1.69)			(2.60)	(1.12)
'Region Involved in Reforms' (Indicator Variable)			0.03***	0.02***	0.03***	0.03***
			(2.84)	(2.27)	(3.61)	(2.89)
Time Since Reform * Region Involved in Reforms					-0.01***	-0.01***
					(4.22)	(3.81)
Regional Economic Basis	0.00**	0.00***	0.00**	0.01***	0.00***	0.01***
	(2.12)	(4.78)	(2.12)	(7.92)	(4.40)	(8.26)
Industry Structure	0.17***	0.22***	0.26***	0.30***	0.25***	0.29***

	(6.29)	(7.61)	(10.39)	(12.04)	(9.96)	(11.37)
Governmental Intervention	-0.02	0.00	-0.06***	0.01	-0.03*	0.01
	(0.85)	(0.17)	(3.56)	(0.58)	(1.73)	(0.68)
Density of Labour Employment	0.21***	0.19***	0.24***	0.21***	0.23***	0.21***
	(7.66)	(7.17)	(8.81)	(7.94)	(8.60)	(7.83)
Human Capital	1.67***	3.22***	1.41***	3.35***	1.63***	3.28***
	(3.20)	(5.74)	(2.94)	(6.61)	(3.41)	(6.48)
2003		-0.01***		-0.01***		-0.01***
2004		-0.01***		-0.02***		-0.02***
2005		-0.01***		-0.02***		-0.02***
2006		-0.02***		-0.02***		-0.02***
2007		-0.02***		-0.03***		-0.02***
2008		-0.02***		-0.03***		-0.03***
2009		-0.02***		-0.03***		-0.04***
2010		-0.02***		-0.04***		-0.04***
Constant Term	0.00	-0.03	-0.08***	-0.12***	-0.08***	-0.11***
	(0.10)	(1.33)	(3.44)	(5.34)	(3.35)	(4.82)
Adj-R^2	0.9159	0.9183	0.1074	0.1481	0.1211	0.1526
Number of Analysed Regions	255	255	255	255	255	255
Sample Size	2295	2295	295	2295	2295	2295

Note: the absolute t-values are in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% respectively

5.1.3 Wage Levels

In addition to analysis regarding the extent of employment, the change in wage levels must also be considered. Consequently, regression analysis has also been done to account and rationalise for the changes in wages. The results in Table 4 mirrors in methodology the same variables and approaches adopted in Table 3 (see subsection 2 "*Employment Rate*").

In examining the regression results with regards to wage levels, the dummy variable 'time since reforms' (comparing pre- and post-reform outcomes) shows a insignificant positive effect on wages should controls for the influence of economic cycle be factored in. This may mean that there is only a slight improvement because of the reforms, mirroring conventional understandings. Additionally, 'region involved in reforms' found a statistically significant correlation for lower wage overall for reformed regions (at a 1% significance level). However, whilst such a pattern can indeed be established, the cause may not necessarily be the VAT reforms nor rising prominence/implementation of 'labour capital substitution'. Rather, it more likely reflects geographical disparities, as the areas having instituted VAT reforms have generally been areas of Northeast and Central China. This is corroborated with the results from the cross term – showing also little change to the wage rates overall. Thus, in conjunction with prior analysis suggesting a decreased expenditure on labour (in favour of capital inputs), one could identify overall enterprise reductions in labour costs as occurring via layoffs as opposed to wage reductions.

Then, we attribute the impact each controlled variable would have towards the regional average wage levels (controlling for variability in the economic cycle). A positive correlative between the regional economic basis upon wage levels can be seen. Additionally, in relation to industry structure, the increase of non-agricultural industries also significantly catalyse higher wages, (at 1% significant level).

Government intervention showed an overall lack of correlation with wages rates, indicating a potentially necessary reconceptualisation of government intervention to truly effectuate change. Contrastingly, the density of labour employment and human capital provides a positive correlation with wage levels, such that increasing density location (often with a larger economy) does lead to overall higher wages.

Finally, by observing models of (2), (4), (6) in Table 4 for the implications of the economic cycle – it could be seen that as compared to 2002, the average wage of full-time workers has all seen a continued upward trend (all to a 1% significant level except for 2003).

Table 4: Regression Model of the Impacts of VAT Reforms Towards Wage Levels (DID Methodology)

	(1)	(2)	(3)	(4)	(5)	(6)
'Time Since Reform' (Indicator Variable)	0.36***	0.01			0.44***	-0.01
	(12.21)	(0.13)			(14.66)	(0.13)
'Region Involved in Reforms' (Indicator Variable)			-0.27***	-0.18***	-0.32***	-0.19***
			(5.94)	(4.07)	(6.50)	(3.83)
Time Since Reform * Region Involved in Reforms					-0.08	0.02
					(1.63)	(0.39)
Regional Economic Basis	0.19***	0.08***	0.25***	0.11***	0.19***	0.11***
	(18.61)	(6.80)	(34.28)	(13.13)	(23.69)	(13.01)
Industry Structure	2.72***	0.78*	0.89***	1.23***	1.11***	1.24***
	(6.18)	(1.84)	(3.44)	(4.99)	(4.36)	(5.01)
Governmental Intervention	1.69***	-0.06	3.29***	0.03	1.64***	0.02
	(5.44)	(0.19)	(13.87)	(0.11)	(6.46)	(0.09)
Density of Labour Employment	0.02	0.43	-0.68*	0.23	-0.45	0.23
	(0.05)	(1.07)	(1.67)	(0.61)	(1.14)	(0.62)
Human Capital	55.22***	4.45	28.63***	4.73	24.86***	4.80
	(6.69)	(0.53)	(5.72)	(0.95)	(5.01)	(0.97)
2003		0.06		0.05		0.05
2004		0.13***		0.11***		0.11***
2005		0.26***		0.23***		0.23***
2006		0.45***		0.40***		0.40***
2007		0.62***		0.56***		0.56***
2008		0.70***		0.62***		0.67***
2009		0.96***		0.87***		0.87***
2010		1.53***		1.04***		1.04***
Constant Term	-1.76***	0.37	-0.13***	-0.06	-0.08***	-0.07
	(4.41)	(0.96)	(0.58)	(0.27)	(0.35)	(0.30)
Adj-R^2	0.6602	0.7077	0.4800	0.5978	0.5300	0.5974
Number of Analysed Regions	255	255	255	255	255	255
Sample Size	2295	2295	295	2295	2295	2295

Note: the absolute t-values are in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% respectively

5.1.4 Correlations Between Variables

The overall results of Tables 2-4 distil that VAT reforms, with its expanding scope of tax deductions have yielded multifaceted impacts. Specifically, it had statistically significant positive impact towards investment intensity and employment rates and was inconclusive towards wage levels at large.

Thus, the following conclusions could be ascertained. Preemptively, whilst VAT reforms have indeed exacerbated the rate at which capital would replace labour as a factor of production, it is manifesting this through layoffs as opposed to wage reductions. However, when considering the rational decision-making of real-life enterprises, this kind of substitution may not be absolute. Such abrupt transformation will increase investment demand while causing fixed asset prices to rise, which in turn inhibits investment and thus acts as an automatic stabiliser in balancing the process.

5.1.5 A Further Conjecture for 'Business to VAT' Implications

'Business to VAT' reforms add transportation and services sectors to its taxable scope, alongside including outsourced labour services VAT tax deductible. When viewing this considering the above research, it could be hypothesised such reforms leads to corporations increasing their investment/expenditure upon outsourced labour services. This is particularly relevant in the logistics sector, where a firm may ultimately choose to outsource their logistics (such as fleets of car for transportation) to third party companies to claim deductibles, increasing the relevance and size of these third-party service providers overall.

5.2 Short- and Long-Term Impacts of the VAT Reform

In accordance with the regression table's modelling, the dependent variables of the regional investment intensity, labour weightings as a factor of production alongside wage levels have been used in testing the impacts of the VAT reforms upon factors of production inputs. Table 5 represents the fixed-effect panel data model in fitting the trend of VAT reform's impact on factor input, following controls for the economic cycle. Within the table, models (1) & (2) have its dependent variable set to investment intensity, models (3) & (4) have the variable as a labour metric weighted as a factor of production, and models (5) & (6) having a dependent variable of the average per capita wage's levels. Overall, these could all aid in distilling the impacts which the VAT reforms imbued within their first five years.

Regression results in models (1) & (2) (in Table 5) shows a statistically significant negative impact of VET reforms to on investment intensity, contrary to its expectations and goals. However, subsequent years have seen fixed asset investments become positively correlated in a sustainable and increasingly observable extent (to a 1% significance level) between 1-5 years. In addition, the adjusted R^2 figures within models (1) & (2) have all respectively been 62.97% and 63.74%, demonstrating a satisfactory fit for the model.

With regards to negative correlation which the VAT reforms yielded within the first year of implementation, this could rather be attributed to the effective lag of policy.

This lag consists of a period of recognition and adjustment before changes could be implemented by the business. Particularly in 2004 and 2007, as the VAT reforms were only announced after the financial year, there lacked incentive for its immediate implementation - as opposed to any appropriate adjustment in the next financial year. This delay is only exacerbated by the inherent stability of employee contracts between businesses and employees, as businesses cannot immediately cut workers in favour of greater capital deployment. Instead, this is carried out on a progressive basis. However, despite these factors being possible in rationalising of the negative first year investment figures, a possible explanation includes business' inter-temporal tax avoidance. Spurred by implications of the VAT reform, companies likely delaying pre-existing planned investments until they could satisfy the applicability criteria for tax deductions at large.

Models (3) and (4) (according to the table) shows positive implications of the VAT reforms within their first year of implementation, and subsequently accompanied by negative implications to labour in all subsequent years (to a 1% level of significance). The adjusted R^2 value have also been 91.81% and 91.90% respectively, demonstrating an exceptional fit for the regression model. As VAT reforms gears towards asset investments, capital constraints of the business as a reality makes it only logical for labour to be deprioritized in favour of a 'capital labour substitution'.

Additionally, a lag for the negative impacts of VAT reforms could similarly be attributed to inter-temporal tax avoidance, as deductions for asset investments would not come into effect until the following year after the reforms.

The regression results of the average regional wage levels of labour are apparent in model (5) & (6). Comparing wage levels and employment rate, the table illustrates that VAT reforms has had lesser impact upon the former. Under constraints dictated by the Rachet Effect of wages, companies would need to reduce employment to change the extents of labour-capital expenditure as opposed to reduce wages overall. The model also has an adjusted R^2 figure of 70.77% and 70.03%, demonstrating a sound fit for the model overall.

Furthermore, closer analysis reveals a negative regression value for the first two years of the reforms, with it rising slightly for the third to fourth years. This matches existing research hypothesis, as it has been suggested that post-reform reductions would be made by businesses in maximising asset investment to capitalise on tax deductions. Thus, with greater deductions easing any cash flow concerns of businesses and the reductions in employment leading to a shrinking of labour costs overall – businesses could then afford to facilitate slight wage increases overall. In contrast to investment intensity and employment, the reform's impact to wage levels appears relatively diminished.

Table 5: Impacts of VAT Reforms Towards Factors of Production Inputs in the Short and Long Terms (2002-2010)

	Investment Intensity		Employment		Wage Levels	
	(1)	(2)	(3)	(4)	(5)	(6)
Year of Reform	-0.05***		0.00**		-0.01	
	(3.24)		(1.83)		(0.15)	
First Year		0.07***		-0.01***		-0.04

		(3.25)		(2.89)		(0.73)
Second Year		0.14***		-0.01**		-0.00
		(4.89)		(2.50)		(0.01)
Third Year		0.17***		-0.02***		0.03
		(5.30)		(2.79)		(0.38)
Fourth Year		0.14***		-0.02***		0.03
		(4.21)		（3.54）		(0.39)
Fifth Year		0.23***		-0.03***		-0.05
		(5.49)		(4.65)		(0.50)
Regional Economic Basis	-0.02***	-0.02***	0.00***	0.00***	0.08***	0.08***
	(4.70)	(5.03)	(4.78)	(4.99)	(6.80)	(6.77)
Industry Structure	0.39**	0.52***	0.22***	0.20***	0.77*	0.77*
	(2.34)	(3.10)	(7.75)	(7.20)	(1.83)	(1.82)
Governmental Intervention	1.28***	1.28***	0.00	0.01	-0.06	-0.07
	(10.38)	(10.47)	(0.22)	(0.26)	(0.19)	(0.21)
Density of Labour Employment			0.19***	0.19***	0.43	0.43
			(7.15)	(7.04)	(1.07)	(1.08)
Human Capital			3.22***	2.96***	4.44	4.55
			(5.76)	(5.30)	(0.53)	(0.54)
Constant Term	0.08	-0.06	-0.06**	-0.04	0.86**	0.87**
	(0.50)	(0.38)	(2.11)	(1.42)	(2.18)	(2.18)
Adj-R^2	62.97%	63.74%	91.81%	91.90%	70.77%	70.73%
Number of Analysed Regions	255	255	255	255	255	255
Sample Size	2295	2295	295	2295	2295	2295

Note: the absolute t-values are in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% respectively

5.3 Tests for Robustness

5.3.1 Internal Validity

Robustness is based on internal validity. Thus, contemplating the internal validity of the double-difference model, the random assignment of treatment/control group (divided randomly) is an important underlying assumption. If the grouping is not completely random, there may be systematic errors and biased estimates.

Accounting for the three stages of VAT reforms – from its trialing in the Northeast Regions in 2004, its expansion into Central China in 2007 (towards 26 priors industrial centres) and encompassing the entire nation in 2009 – the methodology mitigates systematic bias through observing differences between regions prior to the VAT reforms. This includes a comparison between Northeastern States before 2004, and of other VAT-reformed regions before 2007 with its corresponding non-reformed regions, done through the categorisation of indicator variables. Due to limitations in article length, the regression results for the internal validity and the robustness tests would not be explicated, though the data may be provided upon request.

By examining the differences between the "pilot regions" (the three provinces of Northeast China) and non-reformed regions before VAT's first implementation in 2004, the regression results show that compared with other regions, the investment intensity, and average wages of employees in the "pilot regions" are significantly lower, but the employment rate (proportion of number of employees) is not significantly different. In our view, this is mostly due to the three northeastern provinces being old industrial hubs, dominated by a heavy industry-based system

and a government-owned enterprise based corporate structure. This limits their competitiveness compared to other emerging economic regions like the Yangtze River Delta, Pearl River Delta, and Bohai Rim, and diminishes its attractiveness for regional investment. On the one hand, this rationalises the "revitalizing the old industrial base in the Northeast" policy, but also reflects the targeted reformative emphasis and support of the northeast region in this VAT transformation.

In further examining the VAT's second implementation, an analysis of the difference between reformed regions (26 former industrial hubs in central China) prior to 2007 and the remaining regions was undertaken. It was found the employment rate and wage level of the reformed regions before the VAT reforms were already relatively low. This is mainly due to their undue reliance on a single industry (such as coal in Shanxi) leading to the lackluster development of service industries which are characteristic of higher profitability and strong labour absorption.

In concluding an evaluation of this paper's internal validity, it is evident that due to the characteristics unique to each region – including the entrenched industrial foundations of Northeastern provinces, the regional characteristics for Inner Mongolian cities and the disaster-struck Wenchuan have motivated their participation for pilot VAT reforms. Hence, the data cannot be randomly selected samples.

In addressing the above concerns, further regression analysis excluding samples from the Northeastern States and Centra China were undertaken. The results have shown even greater significance, particularly with the negative correlation between VAT reforms and employment rates overall. Other variables remain unaffected both in degree of significance as well as trend. Such, the conclusions reached by this paper could be valid, with its results also being robust.

5.3.2 Contextualising 'Intertemporal Tax Avoidance' Activities

In addition to validating the impacts of the VAT reforms in catalysing an increase in 'capital labour substitution', analysis of the short/long-term effect of VAT reform also revealed how businesses delay their pre-considered investments to capitalise on newly available tax deductions – a practice termed "intertemporal tax avoidance". Here we perform a further test for robustness.

Most significantly in the initial assumption, due to the mixed impacts which the VAT reforms would have within their year of implementation, reforms which have been announced mid-year or later have been categorised as beginning in the subsequent year. In performing a separate regression analysis defining the year of the reform instead as the year which the reforms have been announced (namely 2004, 2007, and 2008), the results attained remained remarkably similar. Only the variable of investment intensity saw a substantial decrease as a result.

This test further validates how with the motive of reducing taxes for investment decisions, businesses have delayed executing original investment plans following the VAT reform. Thus, a change in the proportion of investments allocated for the future years in increasing tax avoidance.

VI. Research Conclusions, Inadequacies, and Future Directions

The VAT reforms, characterised by its greater scope and deductions, have been viewed chronically almost as the 'magic formula' in addressing the issues of double taxation and promoting tax neutrality._From transformation to expansion, VAT reform has experienced its unique endogenous evolution logic -- namely, the expansion of the scope of collection and deduction model in this paper, by constructing two types of manufacturers, the intensity of investment, employment and wages are the main factors of production such as included in the analysis framework of the value-added tax system reform, thus using the 255 Chinese cities (2002-2010 panel data effectively, through the "double difference (DID)" test the VAT reform for regional inputs, effect and short - and long-term effects of the inter-temporal and effectiveness is based on the internal tax incentives of robustness test.)

Based on the empirical analysis of vertical time and horizontal space in this paper, the following findings are made :(1) the VAT transformation promotes "capital replacing labour", and this substitution effect is more realized through layoffs than wage cuts;(2) After replacing the business tax with a VALUE-ADDED tax, compared with the non-deductible own services, enterprises will prefer the outsourcing services that are allowed to be deducted;(3) The effect of VAT reform has a certain time lag, that is, it is more significant in the long run than in the short run;(4) VAT transformation gave rise to the "inter-temporal tax avoidance" of postponing investment;(5) As far as control variables are concerned, factors such as economic foundation, industrial structure, government scale, employment density and human capital also have important influences on regional factor input.

However, there are still some deficiencies in this study. First, in terms of data, the sample size of this paper is relatively large, and deviation may occur in the process of data entry, processing and calculation. Second, some of the theoretical assumptions of this study need to be consolidated. The endogenous growth theory indicates that factor input of production should include factors such as technology and system in addition to traditional capital and labour. It is worth further exploring how to incorporate endogenous factor input into the analysis framework of this paper.

Finally, this paper also puts forward two prospects for future VAT research. On the one hand, compared with the VAT transformation, "replacing the business tax with a VAT" has a larger scope, a more complex reform, and a more far-reaching impact. The next stage will wait for the formation of certain empirical data in "replacing the business tax with a value-added tax" to further test and evaluate the impact of factor input. On the other hand, China's "gradual" VAT reform lasting for many years has provided a very good research sample for us and even the world to study and compare the economic and social effects of different types of VAT systems, such as "production" and "complete consumption", which is one of the directions of future VAT research.