Job Creation Tax Credits and Job Growth:

Evidence from U.S. States

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Abstract

An unemployment rate remaining unacceptably high and monthly job gains barely keeping pace with labor force growth have generated discussions about innovative fiscal policy instruments, such as job creation tax credits (JCTCs), to help stimulate labor demand. This paper studies the effects of JCTCs enacted by U.S. states over the past 20 years. Twenty-three states have adopted JCTCs, and their experiences provide a rich source of information for assessing the effectiveness of such policies. We investigate whether JCTCs affect employment growth before, at, and after the time they go into effect. These questions are investigated in an event study framework applied to monthly panel data on employment, the JCTC effective and legislative dates, and various controls. We find that the employment response to JCTCs depends importantly on whether the credit is anticipated in advance. Anticipated credits tend to have perverse negative effects during the anticipation period and then relatively large positive effects immediately after the credit goes into effect. In contrast, unanticipated credits tend to have positive but relatively modest near-term effects. Based on the sample of unanticipated credits, we find that the JCTC elasticity of employment is 0.35. This estimate suggests that President Obama's recently proposed JCTC would create 280,000 more jobs and would lower the unemployment rate by 0.1 percentage points.

Keywords: Job creation tax credits, state business tax incentives, spatial externalities, anticipation effects, fiscal foresight, implementation lags

JEL codes: H25, H3

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Job Creation Tax Credits and Job Growth:

The Experience of the U.S. States

> Virtually since the Great Recession began, many economists have suggested offering businesses a tax credit for creating new jobs. While details matter, the basic idea is straightforward: Offer tax breaks to firms that boost their payrolls.
>
> Blinder (2013)

1. Introduction

The recent U.S. recession and its aftermath took a heavy toll on nearly all aspects of the economy. Perhaps nowhere was the toll been greater than on the labor market. As of four years after the official end of the recession, the unemployment rate remains unacceptably high and well above estimates of the natural rate.[1] This stubbornly high unemployment rate has generated discussions about innovative fiscal policy instruments, such as job creation tax credits (JCTCs), to help stimulate labor demand. In fact, such discussions began early in the recession and have continued in the midst of the slow recovery, per the above quotation from Blinder. For example, Bartik and Bishop (2009) argued that a "well-designed temporary federal job creation tax credit should be an integral part of the effort to boost job growth." A temporary and narrowly-targeted federal JCTC was adopted in early 2010 and a more substantial measure was proposed more recently by President Obama.[2]

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[1] In a recent study, Daly, Hobijn, Şahin and Valletta (2012) estimate that the natural rate of unemployment is approximately 6.0%.

[2] The 2010 JCTC was part of the *Hiring Incentives to Restore Employment (HIRE) Act*. Only jobs created from the pool of unemployed workers qualified for this credit of 6.2% of wages paid over 52 consecutive weeks of employment. (The HIRE Act also contained a social security tax exemption for employers.) A more substantial JCTC was part of President Obama's 2011 proposed *American Jobs Act* and offered a tax credit of $4,000 for hiring long-term unemployed workers.

While targeted federal tax credits such as the 2010 policy have been enacted in the past, broad-based JCTCs have been tried only once before at the U.S. federal level. The *New Jobs Tax Credit* (NJTC; see Ashenfelter, 1978b and Sunley, 1980) was in effect from 1977 to 1978 and offered corporations a credit whose value was proportional to the increase in the corporation's net payroll level above 102% of its previous year's level. Using survey data, Perloff and Wachter (1979) found that employment growth from 1976 to 1977 was 3.00% higher for firms which reported knowing about the credit compared with other firms. Bishop (1981) also studied the employment effects of the NJTC and found that it increased employment in the Construction, Trucking, Wholesale, and Retail sectors in 1977-1978 by between 0.66% and 2.95%.

Although the federal government's experience with broad-based JCTCs is quite limited, this policy has been pursued by many U.S. states. Nearly half of U.S. states have enacted broad-based JCTCs over the past twenty years. Chart 1 shows the policy diffusion process over time for these state JCTCs (based on the legislative enactment dates that we compiled for this paper). The first of these credits were adopted in late 1992 and, by August 2009, 23 states had adopted such a credit.[3]

Chart 2 shows the geographical distribution of JCTC adoptions. The plurality of JCTC states are in the eastern United States, but there are also many in the Midwest and South. The design of these JCTCs varies among states (discussed in Section 4). The monetary value of the

[3] Here and throughout the paper we focus on JCTCs that are "broad" in the sense that they apply to employers in a wide range of industries, in all parts of the state, and without substantial non-employment-based requirements. Neumark and Grivalja (2013) document that many states additionally have narrow hiring credits targeted at particular industries (such as biotechnology, information technology, or motion pictures), particular areas of the state ("enterprise zones"), or particular actions (such as headquarters relocation, facilities expansion, or research and development).

JCTCs varies substantially among states —variation we will exploit in the empirical analysis below.

An important element in this paper is the creation of a comprehensive database on JCTCs. We compile the relevant legislative dates for all state JCTCs that have been passed in the U.S. since 1990. For each JCTC, we have identified two key dates: (1) the "signing" date on which the legislation is signed into law by the state's governor and (2) the "qualifying" date on or after which net new hires by an in-state employer can qualify for the credit. (These and other terms are defined in the glossary.) The relation between signing and qualifying dates defines two JCTC regimes that may exhibit different employment responses. When the qualifying date occurs after the signing date, employers can perfectly anticipate the forthcoming decline in the effective wage and hence have an incentive to initially decrease employment during this implementation period and then increase it sharply at the qualifying date. We refer to this potential negative effect during the implementation period as an Anticipatory Dip. This is an example of a more general phenomenon of agents altering current behavior due to "fiscal foresight" of policy changes has been the subject of recent debate in macroeconomics.[4] States whose JCTCs have an implementation period are classified as being *delayed* JCTC states. Alternatively, the qualifying date may occur at or before the signing date. We classify these states as *immediate* JCTC states. We combine this JCTC information with monthly data on employment from January 1990 to August 2009 to investigate the average effect of job tax credits on employment growth before, at, and after the qualifying date for each of the two sets of

[4] Auerbach and Gale (2009), Ramey (2011), Leeper, Richter, and Walker (2012), and Mertens and Ravn (2012), among other studies, find a significant impact of fiscal foresight. Perotti (2012), on the other hand, finds no evidence of anticipation effects in advance of pre-announced tax changes.

states. We can thus assess whether JCTCs succeed in stimulating local job growth, the cost per job created, and biases created by the Anticipatory Dip.

Our paper proceeds as follows. Section 2 presents an initial empirical exploration of employment growth before and after the month in which firms qualify for the JCTC. We document that employment growth rises when firms become eligible for JCTCs and that, consistent with fiscal foresight, the increase is larger for delayed-JCTC states and is proceeded by an Anticipatory Dip. Section 3 contains a theoretical framework for understanding the effects of a JCTC and analyzes the intertemporal decisions faced by a firm. Several empirical predictions are generated and the preconditions for Anticipatory Dips are highlighted. Moreover, the theoretical framework provides guidance in correctly measuring the magnitude of the incentive imparted by JCTCs. Section 4 (and the Glossary) describes the unique dataset that we have collected on state JCTCs. Section 5 undertakes some preliminary empirical analyses, examining the factors leading to JCTC adoption and the statistical properties of the monthly employment data. Based on these empirical results, we specify an estimating equation that delivers consistent estimates of the response of employment growth to JCTCs. Section 6 discusses our main empirical results, as well as several robustness checks and extensions. Section 7 relates our results to the thin extant literature on job tax credits and considers policy implications. Section 8 concludes and highlights remaining research questions.

2. Some Initial Empirical Explorations

Before proceeding to a detailed econometric analysis of JCTCs, we undertake a simple event study, comparing employment growth averaged over N months before and after a JCTC event. We define a JCTC event as the first month in which both new employment can qualify for the credit and the credit legislation has been enacted into law. The event window is defined by N, which is either 1, 6, or 12 months. The scatterplots in Chart 3 show employment growth before (on the horizontal axis) and after (on the vertical axis) these events for all JCTC states in our sample. States with a delayed JCTC – where the credit becomes effective one or more months after it is enacted into law – are colored orange/grey; states with an immediate JCTC – where the credit becomes effective immediately upon enactment – are colored black. The solid line in each scatterplot is a 45 degree line. If there is an increase in state employment growth at and after the event date, the data point for that state will lie above the 45 degree line.

Chart 3 documents that employment growth tends to be higher after a JCTC becomes effective. This pattern appears to weaken somewhat as the event window is lengthened from one month to 12 months. Chart 3 also shows that the response to the JCTC is larger, especially in the shorter run, for delayed-JCTC states than immediate JCTC states, suggesting the empirical importance of Anticipatory Dips.

Those visual patterns are confirmed more formally with two sets of t-tests. First, in Table 1, we estimate the employment growth rates for each JCTC state for the period before and the period after the effective date of the credit (the later of the signing and qualifying dates) for windows of 1, 6, or 12 months in panels A, B, and C, respectively. We then calculate the mean pre-JCTC growth rate and mean post-JCTC growth rate over all states (column 1) and separately for the set of delayed-JCTC states (column 2) and the set of immediate-JCTC states (column 3). .

For all windows, we find that mean employment growth is higher after the JCTC goes into effect. The difference is larger the shorter is the horizon. We then perform a t-test on the null hypothesis of equality between the pre-JCTC mean and the post-JCTC mean. For all states and for the delayed states, we can reject equality at the 10% level; for immediate states, equality cannot be rejected at conventional significance levels.

Our second t-test assesses whether the difference-in-difference – that is, the difference between delayed and immediate states in the mean pre-to-post JCTC employment growth difference – is significantly different from zero. The results are presented in the last row of each panel. We find that for the 1 month window, the difference-in-difference is positive (the pre-to-post growth is higher for delayed than immediate states) and significant at the 1% level. For the 6 and 12 month windows, the differences are smaller and not statistically significant at conventional levels.

We conclude our preliminary analyses with a comparison of the pre-to-post JCTC employment growth between states that differ in terms of key discrete characteristics of the credits: whether the tax credit is nonrefundable (the employer cannot receive a refund if the value of the credit exceeds its tax liability), requires pre-approval by a state agency, or is capped (the total amount of the tax credit is restricted either by a state-wide or single-taxpayer limit). Each of these characteristic potentially lowers the value of the credit. States whose JCTC has one of these characteristics are expected to have lower relative employment growth. The results, based on N=6 months, are shown in Chart 4. Of the three characteristics, the only one in which there is clear relative difference in the pre-to-post JCTC employment growth is refundability. Formal difference-in-difference t-tests (not shown) confirm this visual impression: the pre-to-post JCTC employment growth difference averages 0.10 percentage points higher for states in which the credit is refundable; the difference is statistically significant with a p-value of 0.056.

This preliminary analysis suggests that JCTCs positively affect employment growth over the short-term and especially so for delayed states and for states in which the credit is refundable. However, a more complete analysis needs to use a value-based measure of the JCTC and condition on potential confounding factors. A more complete analysis must also assess the extent to which the higher short-term impact of JCTC in delayed regimes comes at the cost of any negative Anticipatory Dips in employment prior to the tax credit's effective date. We begin the exploration of the latter in terms of the theoretical model developed in the next section.

3. Theoretical Framework

This section presents a dynamic model of the firm that provides guidance about the patterns of policy-response coefficients we should expect from a forward-looking firm facing a JCTC. We begin by defining the firm's cash flows and the constraints that it faces. The first-order conditions (FOCs) characterizing optimal behavior are examined. These determine the steady-state values for three real variables – labor, output, and sales, as well as the transition behavior in the face of a policy stimulus. The adoption of a JCTC is then analyzed in three models of increasing generality in terms of the responses of the real variables away from the steady-state. We focus on the delayed-JCTC regime, which contains an implementation period between signing and qualifying months, highlight several empirical implications and identify the three key conditions necessary for the emergence of Anticipatory Dips.

A. Optimization Problem

Cash flow in period t is composed of four elements. First, revenues (REV_t) accrue to the firm from sales (S_t) in a market where the firm may have market power ($P_t = P[S_t], P'[S_t] \leq 0$). The demand curve is linear with slope ($-\beta / 2$) and a constant term equal to ($1+\beta$). The linearity assumption is made for convenience; the parametric restriction as a simple device for assuring that, in the steady-state (SS), the firm faces an elastic demand curve for any value of β,

$$REV\left[S_t\right] \equiv P_t * S_t = \alpha * S_t - (\beta / 2) * S_t^2 , \tag{1a}$$

$$\alpha \equiv 1+\beta , \tag{1b}$$

$$\left| \frac{dS_t}{dP_t} \frac{P_t}{S_t} \right|_{SS} = (1+2/\beta) > 1 \qquad 0<\beta<\infty , \tag{1c}$$

where we assume in equation (1c) that the steady-state value of S_t equals one (an assumption verified in Section 3.C).

Second, labor is the only factor of production, and production cost ($COST_t$) is the product of an exogenous wage (w) and labor input (L_t),

$$COST[L_t] \equiv w * L_t \ . \quad (2)$$

Third, the firm smooths production intertemporally by adjusting the end-of-the-period inventory stock (I_t). The firm has a target inventory-to-sales ratio (ζ) that is given exogenously. Deviations from this target result in the following quadratic cost,

$$f[I_{t-1}, S_t] \equiv (\mu / 2) * \left(I_{t-1} - \zeta * S_t\right)^2 \qquad \mu \geq 0 . \quad (3)$$

Such a cost is standard in the inventory literature (cf., Ramey and West (1999, equation 3.1)) and represents inventory holding and stockout costs. If $f[.]$ is linear, $\zeta = 0$, and $(\mu / 2)$ equals the cost of borrowed funds, then equation (3) would represent the carrying cost of inventory.

Fourth, the firm receives a job creation tax credit equal to the product of the tax credit rate (τ_t), the wage rate, and the level of credit-qualifying employment. For the state credits in our sample, credit-qualifying employment is current employment, L_t, minus employment in the previous period, L_{t-1} (or averaged over several previous periods such as the past 12 months). Because the previous period is not a fixed interval at a point in time but rather a window that moves forward in time with employment, this type of credit is known as a "rolling base" credit. The rolling base feature of these credits has important implications on the incentives from and the cost of tax credit programs. These implications are examined in subsection E below. Here we assume a rolling base and the tax credit received by the firm is defined as follows,

$$g[L_t, L_{t-1} : \tau_t] \equiv \tau_t * w * \left(L_t - BASE_t\right), \quad (4a)$$

$$BASE_t \equiv L_{t-1} . \tag{4b}$$

The tax credit rate is noted explicitly in equation (4a) as a conditioning variable given its central role in the subsequent analysis.

In maximizing cash flow qua profits over the planning period, the firm faces production function, inventory accumulation, and isoperimetric constraints. The production function depends only on labor,[5]

$$Q_t = L_t^{(1/\delta)} \qquad \delta > 1 , \tag{5}$$

where the returns to labor are decreasing and $\delta > 1$. The latter property is required for satisfying the second-order conditions (cf. fn. xx) and the uniqueness of the steady-state (cf. fn. xx). The end-of-period inventory stock is accumulated according to the following recursive equation,

$$I_t = Q_t - S_t + I_{t-1} . \tag{6}$$

Equation (6) will be appended to the optimization problem with a time-varying shadow price, θ_t. The final constraint concerns the inventory stock at the end of the planning period. The firm begins the planning period with an inventory stock, I_0. If left unconstrained, the firm will end the planning period at time T with the inventory stock completely depleted, and some of its profit will be illusory. To avoid this extreme inventory drawdown that would distort profits and employment decisions, we require that $I_T = I_0$, which, after repeated substitution with equation (6), is equivalent to the following isoperimetric constraint,

$$I_T - I_0 = 0 = \sum_{t=1}^{T} \left(Q_t - S_t \right) . \tag{7}$$

[5] This formulation of the production function is consistent with a constant returns-to-scale production function with labor and a fixed factor as arguments, where the latter is normalized to one and fixed during the length of the period over which we evaluate the impact of the JCTC.

Note that this is a weaker constraint than the special case of assuming the firm starts with zero inventory because, in this special case, the firm will optimally deplete the inventory stock completely by period T and $I_T = I_0 = 0$. The constraint in equation (7) will be appended to the optimization problem with a time-invariant shadow price, ϕ. In combination with the downward-sloping demand curve, this constant shadow price of output plays a critical role in the intertemporal allocation of labor, output, and sales for a firm facing a delayed-JCTC, and they are necessary conditions for the emergence of anticipatory dips.

Combining the four relations defining cash flow (CF_t), discounting CF_t by a constant discount factor (R^t depending on a constant discount rate ρ), assuming that cash flows accrue at the end of the period, substituting L_t for Q_t with equation (5), and appending the two constraints, we write the dynamic optimization problem as follows,

$$\Pi_0 = \underset{\{L_t, S_t, I_t\}}{\text{Max}} \sum_{t=1}^{T} R^t \left\{ CF\left[L_t, S_t, I_{t-1}, L_{t-1} : \tau_t\right] + \theta_t \left(I_t - L_t^{(1/\delta)} + S_t - I_{t-1}\right) + \phi \sum_{t=1}^{T} \left(L_t^{(1/\delta)} - S_t\right) \right\}, \tag{8a}$$

$$R^t \equiv (1+\rho)^{-t} \qquad \rho > 0, \tag{8b}$$

$$CF\left[L_t, S_t, I_{t-1}, L_{t-1} : \tau_t\right] \equiv \left(REV\left[S_t\right] - COST\left[L_t\right] - f[I_{t-1}, S_t] + g[L_t, L_{t-1} : \tau_t]\right). \tag{8c}$$

B. First Order Conditions

The firm maximizes discounted cash flows by appropriate choices of labor, sales, and the inventory stock. Given the inventory accumulation constraint, the latter variable is predetermined by the choices of labor and sales, and it could be eliminated from equation (8) with equation (6). We include I_t explicitly in equation (8) to facilitate the interpretation of the first-order conditions. We begin with the perturbation of equation (8) with respect to I_t,

$$I_t: \quad -R*\mu\left(I_t-\zeta*S_{t+1}\right)+\theta_t-R*\theta_{t+1}=0, \tag{9a}$$

→

$$\theta_t=\sum_{s=0}^{T}R^{t-s-1}\ \mu\left(I_{t+s}-\zeta*S_{t+s+1}\right). \tag{9b}$$

Equation (9a) is a first-order difference equation in θ_t.[6] It can be solved by recursive substitution for θ_{t+s} and by imposing the terminal condition that that θ_T equals zero (discussed below). This solution is presented in equation (9b) and defines θ_t as the shadow price of adding a unit of inventory in period t and keeping that unit in inventory until period T. If in period t, the inventory stock exceeds its target level $\left(\left(I_{t+s}-\zeta*S_{t+s+1}>0\right),\forall s=0,T\right)$, an addition to inventory aggravates the imbalance, is costly to the firm, and $\theta_t>0$.[7] These incremental costs are increasing in μ and are discounted by R. If in period t, the inventory stock is below its target level, then the additional unit is beneficial to the firm, the incremental cost is negative, and $\theta_t<0$. In the steady-state, the inventory stock equals its target level, the inventory imbalance is zero, and $\theta_t=0$.

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[6] If the cash flow term defined in equation (8c) had included an inventory carrying cost ($c*I_{t-1}$), this additional cost term would have merely redefined θ_t. Inventory carrying costs would enter equation (9a) as $-R*c$ and, in this case, equation (9b) would contain an additive constant multiplied by the discount factor.

[7] We assume that the inventory imbalance is reduced monotonically to zero. Given the quadratic specification, inventory imbalances of either sign are penalized, and it would be unnecessarily costly for the firm to overshoot the steady-state value.

The key decisions made by the firm concern labor and sales. The first-order condition for the choice of labor is as follows,

$$L_t: \quad w*\left(1-\tau_t+\tau_{t+1}*R\right)+\theta_t*\left(L_t^{((1-\delta)/\delta)}/\delta\right)=\phi*\left(L_t^{((1-\delta)/\delta)}/\delta\right), \tag{10a}$$

→

$$MPL\left[L_t\right]=w_t^{EFF}/\left(\phi-\theta_t\right) \qquad w_t^{EFF}\equiv w*\left(1-\tau_t+\tau_{t+1}*R\right), \quad MPL\left[L_t\right]\equiv\left(1/\delta\right)*L_t^{((1-\delta)/\delta)} \tag{10b}$$

→

$$L_t=\left(\frac{\phi-\theta_t}{\delta*w_t^{EFF}}\right)^{(\delta/(\delta-1))}, \tag{10c}$$

$$Q_t=\left(\frac{\phi-\theta_t}{\delta*w_t^{EFF}}\right)^{(1/(\delta-1))}. \tag{10d}$$

The two terms on the left side of equation (10a) define the total cost from hiring an incremental worker (and hence producing an incremental unit of output). The first term reflects labor costs represented by the effective wage rate, w_t^{EFF}, which is equal to the sum of the cost of hiring labor (w) less the tax credit received in period t ($-w*\tau_t$) and, owing to the rolling base feature of the tax credit (discussed in more detail in sub-section E), plus the tax credit that will not be received in period t+1 ($w*\tau_{t+1}*R$). The second term is the cost of adding to an inventory imbalance. If θ_t is positive due to a positive inventory imbalance, incremental output from a new hire increases the imbalance and is costly to the firm. These incremental costs are equal to the benefit from an additional hire, which is represented by the term on the right side of equation (10a). This term is the constant shadow price of output, ϕ, multiplied by the marginal product of labor.

These relations are rearranged into a more concise expression in equation (10b), which shows that labor is optimally chosen such that its marginal product equals labor's effective wage rate "deflated" by the true price of output, which is its shadow price net of any inventory imbalance cost. Equation (10c) is a rearrangement of equation (10b) and relates L_t to the production function parameter, shadow prices, and the effective wage rate. Equation (10d) is the corresponding expression for Q_t.

The second key choice by the firm concerns sales with the following first-order condition,

$$S_t: \quad (\alpha - \beta * S_t) + \mu * \zeta (I_{t-1} - \zeta * S_t) + \theta_t = \phi, \tag{11a}$$

→

$$S_t = \frac{\alpha + \mu * \zeta * I_{t-1} + \theta_t - \phi}{\beta + \mu * \zeta^2} \; . \tag{11b}$$

Equation (11a) is a perturbation of equation (8) that impacts cash flow in three ways. The first term in equation (11a) is the marginal revenue, which decreases in the level of sales because of the downward-sloping demand curve. The second term reflects the cash flow from a change in the target and depends on the sign of the inventory imbalance. An increase in sales (and hence the target level of inventory) reduces a positive imbalance and adds to cash flow. The impact is negative when the inventory imbalance is negative. Note that this effect disappears if the target level is zero ($\zeta = 0$). The third term is the shadow price of inventory imbalances. The shadow price's impact on an incremental sale is opposite to its impact on labor because Q_t (dependent on L_t) and S_t have opposite but numerically identical effects on the inventory stock. If this cost is positive due to a positive inventory imbalance, an incremental sale reduces the imbalance and increases cash flow. These three terms define the total cash flow from an incremental sale and, under profit-maximization, equal the constant shadow price of output, ϕ. Equation (11b) is a rearrangement of equation (11a) that relates S_t to demand curve parameters, the predetermined inventory stock, and shadow prices.

Lastly, perturbations of the shadow prices yield the per-period inventory accumulation constraint and the planning-period isoperimetric constraint, respectively,

$$\theta_t: \quad I_t = L_t^{(1/\delta)} - S_t + I_{t-1}, \tag{12}$$

$$\phi: \quad \sum_{t=1}^{T}\left(L_t^{(1/\delta)} - S_t\right) = 0, \tag{13}$$

C. Steady-State.

These first-order conditions form the basis of our analysis of the steady-state and transition associated with a delayed-JCTC. In this sub-section, we analyze a steady-state defined by two characteristics: the inventory stock equaling its target value ($I_{SS} = \zeta * S_{SS}$) and sales equaling output ($S_{SS} = Q_{SS}$). The first characteristic implies that $\theta_{SS} = 0$ and that sales and output given by equations (10d) and (11b), respectively, can be written as follows,[8]

$$Q_{SS} = \left(\frac{\phi_{SS}}{\gamma * w_{SS}^{EFF}}\right)^{(1/(\gamma-1))}, \tag{14}$$

$$S_{SS} = \frac{\alpha - \phi_{SS}}{\beta}. \tag{15}$$

[8] In the steady-state, the second-order conditions can be verified. The matrix of second derivatives for L and S is as follows, $\begin{bmatrix} ((1-\gamma)/\gamma) * L^{((1-2\gamma)/\gamma)} & 0 \\ 0 & -\beta \end{bmatrix}$, which is negative definite for $\gamma > 1$. Note that the first-order condition for I_t vanishes in the steady-state.

In order to analyze how variables respond to the introduction of a JCTC, we consider an initial steady state in which there is no JCTC, and hence $w_{SS}^{EFF} = w$. In order to form baseline values, we adopt the normalization that $w = \left(1/\gamma\right) < 1$. The second characteristic implies the following solution for the shadow price of output,

$$Q_{SS} = S_{SS} \rightarrow h\left[\phi_{SS}\right] = 0 \rightarrow \phi_{SS} = 1 \;, \tag{16a}$$

$$h\left[\phi_{SS}\right] \equiv \beta\left(\phi_{SS}\right)^{(1/(\gamma-1))} + \phi_{SS} - \alpha \;. \tag{16b}$$

The unique solution to equation (16) is $\phi_{SS} = 1$.[9] With this value for the shadow price of output, $S_{SS} = Q_{SS} = L_{SS} = 1$. The critical result here is that the optimal choice of labor in the initial steady state is 1. Therefore, any deviations from 1 reflect the effects of introducing a JCTC.

D. Responses To A JCTC: No Rolling Base; No Inventory Costs

We now examine the firm's responses to the introduction of a JCTC. In order to highlight three different channels of influence, we will examine in this sub-section a special case of the model in which the JCTC does not have a rolling base and the inventory technology is costless. Sub-section E reintroduces the rolling base. Sub-section F contains a general model with the rolling base and costly inventory.

In anticipation of the empirical analysis, we divide the timeline for a delayed-JCTC into three intervals:

BEFORE: The months between the signing date and the qualifying date.

AT: The month containing the qualifying date.

[9] A value of $\phi_{SS} = 1$ is a solution to equation (16). Since $h[0] \leq 0$, $\lim_{\phi_{SS} \rightarrow \infty} h[\phi_{SS}] \rightarrow +\infty$, and $h'[\phi_{SS}] > 0 \;\; \forall \phi_{SS} > 0$, we can verify that $\phi_{SS} = 1$ is the unique solution to $h[\phi]$ provided $\gamma > 1$, $\alpha = 1 + \beta$, and $\beta \geq 0$.

AFTER: The months after the qualifying date. The AFTER interval will be further divided into AFTER-EARLY and AFTER-LATE in the general model and the empirical work.

We assume that the firm begins in the steady-state with no JCTC. At the beginning of the planning period, policymakers adopt a permanent JCTC with a "qualifying date" (the date at which time employment above the credit base qualifies for the credit) in the future. This *delayed-JCTC* regime leads to some very interesting dynamic behavior that we study in terms of its effect on employment in the BEFORE and then in the AT and AFTER intervals. There are two restrictive assumptions adopted in this sub-section. The rolling base is eliminated so that $BASE_t \equiv 0$ or a constant in equation (4b). We maintain that there is an inventory stock that allows production to be smoothed across periods, but inventory costs are absent ($\mu = 0$). The first-order conditions for labor and sales for this restricted model are as follows,

$$L_t = \left(\frac{\phi}{\gamma * w_t^{EFF}} \right)^{(\gamma/(\gamma-1))} \qquad w_t^{EFF} \equiv w \qquad t \in \{BEFORE\}, \tag{17a}$$

$$L_t = \left(\frac{\phi}{\gamma * w_t^{EFF}} \right)^{(\gamma/(\gamma-1))} \qquad w_t^{EFF} \equiv w * (1 - \tau_t) \qquad t \in \{AT, AFTER\}, \tag{17b}$$

$$S_t = \frac{\alpha - \phi}{\beta} \qquad t \in \{BEFORE, AT, AFTER\}. \tag{17c}$$

The introduction of the JCTC lowers w_t^{EFF} in the AT and AFTER intervals. Thus, L_t rises at the time of the qualifying date and stays permanently higher. These initial hiring and production plans lead to an imbalance with S_t, which, for the moment, remains fixed. A change in the shadow price of output restores the balance over the planning period. Per equations (17), the decline in ϕ (below its initial steady state value of 1) has three effects. First, it raises S_t

uniformly in all three intervals. Second, it lowers L_t and Q_t in the BEFORE interval relative to the initial steady-state. Third, it also lowers L_t and Q_t in the AT and AFTER intervals. However, this decrease is more than offset by the increase from the lower effective wage rate.[10] The adjustment process continues until the increased level of sales matches the increased level of output over the planning period.

These dynamics are illustrated in Chart 5 that plots output and sales over time. (Recall that employment is monotonically increasing in output, $L_t = Q_t^{\delta}$, $\delta > 1$.) Output and sales do not move in tandem. As a result of the negatively-sloped demand curve, the firm smoothes sales over time, and S_t is constant over the planning period (indicated by the flat dashed line in the figure). However, with the delayed-JCTC and the zig-zag pattern of L_t, inventory is drawn down in the BEFORE interval and subsequently rebuilt in the AT and AFTER intervals. Inventory accumulation is costless in this restricted model, and no incentive exists to eliminate the imbalances quickly. Consequently, production in the AT and AFTER intervals is constant because of the curvature of the production function.

This analysis of a delayed-JCTC generates Anticipatory Dips due to fiscal foresight: even though the effective wage rate in the BEFORE interval does not change, employment in that interval falls relative to its prior steady-state value. This change represents a shift in

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[10] This net effect depends on the properties of the term $\phi_{SS} / (\delta * w_{SS}^{EFF})$ appearing in equation (14); specifically, the elasticity of ϕ with respect to w_{SS}^{EFF} ($\varepsilon_{\phi, w_{SS}^{EFF}}$) must be less than one. To evaluate this condition, rewrite the steady-state relation $h\left[\phi_{SS}\right]$ in terms of w_{SS}^{EFF} (which does not generally appear in $h\left[\phi_{SS}\right]$ because of the normalization): $h\left[\phi_{SS}\right] = \kappa\left[\phi_{SS}[w_{SS}^{EFF}], w_{SS}^{EFF}\right] \equiv \chi\left[w_{SS}^{EFF}\right] \equiv \beta\left(\phi_{SS}[w_{SS}^{EFF}] / (\delta * w_{SS}^{EFF})\right)^{(1/(\gamma-1))} + \phi_{SS}[w_{SS}^{EFF}] - \alpha$. In any steady-state, $Q_{SS} = S_{SS}$ and hence $\chi'\left[w_{SS}^{EFF}\right] = 0$ through an adjustment in ϕ to the change in w_{SS}^{EFF}. Differentiating $\chi\left[w_{SS}^{EFF}\right]$ with respect to w_{SS}^{EFF}, setting the derivative equal to zero, and evaluating this derivative at the original steady-state, we obtain $\varepsilon_{\phi, w_{SS}^{EFF}} = \left(\beta / (\beta + \delta - 1)\right) < 1$ provided $\delta > 1$ and $\beta > 0$.

production from high-cost to low-cost periods as the firm, foreseeing the future drop in the effective wage rate, adopts an intertemporal production plan that minimizes average production costs and satisfies an endogenous sales constraint.

Decreasing returns to labor, a downward-sloping demand curve, and an inventory technology are each necessary for Anticipatory Dips. If the returns to labor were increasing, then the firm would have an incentive to bunch production in the AT interval absent inventory costs in this restricted model.[11] The absence of either of the remaining two conditions would lead to a sequence of static optimization problems. If the firm faced a perfectly elastic demand curve, then all of period t's production could be sold without the penalty from declining marginal revenues. In this case, the dynamic elements in the optimization problem disappear, the firm sets period t production based only on the period t wage rate, and output and employment do not change in the BEFORE interval. Lastly, if there is no inventory technology, then $Q_t = S_t$ in each period, and the firm no longer has a separate sales decision.[12] In this case, the inability to change inventory prevents the firm from taking advantage of the differential production costs due to the delayed implementation of the JCTC program. Again, the dynamic optimization problem becomes a sequence of static problems, and there are no interrelations among wage rates in different periods. With a concave production technology and a negatively-sloped demand curve, the firm has the motivation to smooth sales and reallocate production but, absent an inventory technology, it does not have the means to shift production across periods. All three elements are

[11] If the returns to labor were constant, the firm would be indifferent to producing in any period other than the first.

[12] If an inventory technology is not available to the firm, the inventory accumulation constraint $(I_t = Q_t - S_t + I_{t-1})$ would be removed from the optimization problem (equation (8a)) and S_t would be replaced by Q_t for all t.

needed to provide the firm the motivation and means to shift employment and generate anticipatory dips.

E. Responses To A JCTC: No Inventory Costs

We now relax one of the two restrictions and analyze the effects of the rolling base on the response to the delayed-JCTC. The qualitative effects on employment are identical to those documented in Section III.D, though the quantitative effects differ. With a rolling base, the effective wage (equation (10b)) is impacted differently in the BEFORE interval and then in the AT and AFTER intervals,

$$\frac{\partial w_t^{EFF}}{\partial \tau_t} = w * R > 0 \qquad t \in \{BEFORE\}, \qquad (18a)$$

$$\frac{\partial w_t^{EFF}}{\partial \tau_t} = -w * (1 - R) = -w * (\rho / (1 + \rho)) < 0 \qquad t \in \{AT, AFTER\}. \qquad (18b)$$

Somewhat paradoxically, the introduction of the JCTC <u>raises</u> the effective wage rate in the BEFORE interval. With a delayed-JCTC, the firm is not eligible to receive the tax credit in the BEFORE interval, and hence obtains no benefits. However, any hiring in the BEFORE interval raises the employment base above which subsequent employment must rise in order to qualify for the credit. Hence, employment in the BEFORE interval lowers the value of the credit in future periods. Being forward-looking, the firm internalizes this cost when choosing employment in the BEFORE interval. This negative effect on profitability is reflected in the higher effective wage rate in equation (18a). In the AT and AFTER intervals, the JCTC lowers effective wages. However, the quantitative impact is dramatically reduced by the rolling base feature of the tax credit. The $\rho / (1 + \rho)$ term in equation (18b) reflects that, with a rolling base, eligible incremental employment receives a tax credit today but at the expense of eliminating the tax credit on incremental employment tomorrow. This latter cost is discounted and, hence the overall stimulus from the tax credit increases with the discount rate. Since the discount rate is generally a small number, the rolling base feature substantially attenuates the impact of a JCTC and affects the specification of the JCTC in the econometric equation. In the extreme with no discounting ($\rho = 0$), the credit provides no stimulus at all.

The path of optimal sales and output (and implicitly labor) over time in this case are illustrated in Chart 6. For comparison purposes, these paths overlay the corresponding paths in the no-rolling-base case from Chart 5. Relative to that restricted model, the introduction of the rolling base raises the effective wage rates and lowers labor in both the BEFORE and AT/AFTER intervals. The quantitative extent of these decreases depends on the derivatives in equation (17) and the impact of these changes in w_t^{EFF} on ϕ (cf. fn. 7). This shadow price of output adjusts to correct imbalances between output and sales over the planning horizon. Evaluated at the steady-state value of $\phi = 1$, the initial imbalance is less in this model than in the no-rolling-base case because the fall in employment (hence output) over the entire planning period is relatively lower. Consequently, the fall in ϕ and the rise in S_t will be less than in the restricted model, though these movements will be in the same direction.

F. Responses To A JCTC: The General Model

This sub-section analyzes the general model in which the JCTC has the rolling-base and inventory is costly. We introduce the latter effect by allowing $\mu > 0$. The first-order conditions for the general model are modified by including terms containing the cost of inventory imbalances (μ interacted with the inventory/sales target, ζ) and the shadow price of adding to inventory imbalances (θ_t),

$$L_t = \left(\frac{\phi - \theta_t}{\delta * w_t^{EFF}} \right)^{(\gamma/(\gamma-1))} \qquad w_t^{EFF} \equiv w * \left(1 + \tau_{t+1} * R\right) \qquad t \in \{BEFORE\}, \tag{19a}$$

$$L_t = \left(\frac{\phi - \theta_t}{\delta * w_t^{EFF}} \right)^{(\gamma/(\gamma-1))} \qquad w_t^{EFF} \equiv w * \left(1 - \tau_t + \tau_{t+1} * R\right) \qquad t \in \{AT, AFTER\}, \tag{19b}$$

$$S_t = \frac{\alpha + \mu * \zeta * I_{t-1} + \theta_t - \phi_{SS}}{\beta + \mu * \zeta^2} \qquad t \in \{BEFORE, AT, AFTER\}. \tag{19c}$$

The introduction of costly inventory changes the quantitative but not the qualitative effects of the JCTC analyzed above. With S_t and ϕ held at their initial steady-state levels, employment initially decreases in the BEFORE interval and increases in the AT and AFTER intervals. The BEFORE response in employment results in an inventory drawdown, $\theta_t < 0$ (per equation (9b)), and incremental employment in all periods becomes more valuable by reducing the inventory imbalance. Consequently, an unambiguous implication of the general model is that, when there are inventory costs, employment falls less in the BEFORE interval.

The relative change in employment in the AT and AFTER intervals is subject to two contrasting effects and the net effect is ambiguous. Since the inventory drawdown in the BEFORE period is lower, less subsequent employment is needed to replenish inventory. However, in the AT and the early stage of the AFTER intervals, there is an added incentive to hire labor and produce output to eliminate the costly inventory imbalance, and relative employment rises.

Inventory, its shadow price, and sales respond differently in subsequent periods relative to the model in sub-section E. In the face of a negative inventory imbalance, an incremental sale aggravates the imbalance and becomes less valuable in a model with costly inventory. The inventory imbalance is largest in the BEFORE interval and falls over time. The decrease in the imbalance results in an increase in θ_t that stimulates sales. Rather than being constant over the planning period, sales in the general model rises over time. As in all models considered here, ϕ adjusts so that the inventory imbalance is eliminated by the end of the planning period at which time $\theta_T = 0$.

Chart 7 summarizes the theoretical predictions for the path of employment over the planning period and the interesting dynamics associated with a delayed-JCTC. With a delayed-JCTC, employment falls after the credit is enacted (at date t^S) as forward-looking firms delay hiring and draw down inventories to meet current demand. This decline is amplified when the value of the tax credit is computed with a rolling base. The combined effect is illustrated by line segment AB. When the JCTC goes into effect (at date t^Q), employment rises sharply for several reasons: rebuilding the work force (line segment BC), responding to the lower effective wage rate (line segment CD), and replenishing inventory (line segment DE). Note that only the response indicated by line segment CD represents the "true" short-run stimulative effect of a JCTC. Gradually, employment falls as inventories return toward their steady-state levels, but it remains above the original employment level because of lower labor costs (line segment AF, which is the same length as line segment CF). The AFTER interval is divided into EARLY and LATER stages in order to recognize that firms may not be able to react to JCTC incentives in a single month owing to adjustment and decision-making frictions. Thus, we might expect that the sign for the AFTER-EARLY interval is a mix of positive employment at the qualifying date and negative employment as inventories are replenished and the work force reduced.

G. Immediate-JCTC vs. Delayed-JCTC Regimes

The above analysis has focused on a delayed-JCTC regime, which has been adopted by nine states between 1990 and 2009. For a JCTC that goes into effect immediately, as is the case in 13 states, the pattern of employment in the AT, AFTER-EARLY, and AFTER-LATE intervals is qualitatively similar to those displayed in Chart 7.[13] An important difference is that the Anticipatory Dips in output and employment that occur in delayed-JCTC states (line segment AB) are absent for immediate-JCTC states. In the latter case, in which firms qualify for the JCTC at t^Q, the employment increase in the AT interval will be smaller than it is for firms in the delayed-JCTC states because there is no need to compensate for deferred hiring and inventory drawdowns. Thus, analyzing employment responses in immediate-JCTC states provides a clean read on the true effectiveness of JCTCs (line segment CD), whereas employment responses in delayed-JCTC states with implementation lags and rolling bases may overstate the effectiveness of tax credits (by the sum of the line segments BC and DE). These predictions are summarized in Table 2.

4. Data

JCTCs are credits against a state's corporate income or franchise tax. This section describes the unique state-level JCTC data that we have collected and contains details about the identification, valuation, and design of JCTCs. The second sub-section briefly discusses the employment data and lists the control variables used in the econometric analyses.

A. Job Creation Tax Credits (JCTCs)

1. Identifying And Dating

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[13] For six of the 13 immediate JCTC states, the JCTC is retroactive in the sense that the qualifying date precedes the signing date by more than 15 days. (For each retroactive JCTC state in our sample, the qualifying date is January 1 of the year in which the credit was signed into law. In these cases, only net employment increases made after January 1 can qualify for a credit.) Since the empirical implications for firms confronting these retroactive JCTC states are similar to those for the other immediate JCTC states, there is no a priori reason for separating them in the econometric analyses.

We focus on broad-based JCTCs and identify states with these tax credits in three steps. First, we use Rogers (1998) to identify state JCTCs in place as of 1997. None of these JCTCs were enacted before 1993 (as indicated in Chart 1). Second, *Site Selection*'s website (www.siteselection.com) contains tables documenting various state tax incentives from 1997 onward. Third, we supplement these sources with, for each state, a general web search for "tax credits" and a more targeted search in the legal database *WestLaw*. We believe that we have identified all broad-based JCTCs for which both the signing and effective dates are within the period January 1990 and August 2009. In our empirical analyses, we exclude credits that were enacted or went into effect after the start of the Great Recession in December 2007.[14] With this cutoff rule, we avoid potential confounding effects on employment from the financial crisis, the ensuing downturn, and the large policy responses such as the federal 2009 Recovery Act whose tax cuts and spending levels varied by state.[15]

Having identified all 23 states that have or have had a JCTC, we then use *WestLaw* to obtain the state statute code for the legislation associated with the JCTC The state statute code identifies the session law that includes the bill signed into law, officially authorizing the credit. States session laws and bills are found either in *WestLaw* or on the state's house/assembly website. These bills contain all of the relevant information on each JCTC needed for this paper. (These bills are available from the authors upon request.)

2. Valuing

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[14] The December 2007 cutoff rules out recently enacted credits in Colorado, Idaho, Indiana, Massachusetts, and Tennessee.

[15] Wilson (2012) documents the large cross-state differences in the federal stimulus provided by the 2009 American Recovery and Reinvestment Act and finds that the stimulus spending had a substantial impact on state employment. See, also, Neumark and Grivalja (2013) for a study of the impact of JCTCs during the Great Recession.

The key regressor in our baseline regressions is a state's effective tax credit rate. As shown in the model above (equations 19), the degree to which a permanent JCTC alters the effective wage is importantly affected by the rolling base feature of the credit. Our model implies that, the effective wage rate ($w_{i,t}^{EFF}$) is defined as follows,

$$w_{i,t}^{EFF} = w_{i,t} * \left(1 + \tau_{i,t} / (1+\rho)\right) \qquad t \in \{BEFORE\}, \tag{20a}$$

$$w_{i,t}^{EFF} = w_{i,t} * \left(1 - \tau_{i,t} * (\rho / (1+\rho))\right) \qquad t \in \{AT, AFTER\}, \tag{20b}$$

$$\tau_{i,t} = \tau_{i,t}^{LEG} * ELIGIBLE_{i,t}. \tag{20c}$$

The legislated tax credit rate ($\tau_{i,t}^{LEG}$) comes explicitly or implicitly from the legislation that enacted the credit, and it will be discussed below (equation (21)). The legislated rate is adjusted for the proportion of firms eligible to use the credit ($ELIGIBLE_{i,t}$).

In equations (20a) and (20b), the signs preceding $\tau_{i,t}$ and the scalars $(1/(1+\rho))$ and $(\rho/(1+\rho))$ reflect the rolling base aspect of the state JCTCs. Because a new hire today adds to the employment base that defines credit-eligibility for future employment, the credit is effectively a one-time, temporary credit. The key implications are that the rolling-base aspect of the tax credits in our sample makes their effective values much smaller than their legislated values. In particular, assuming an expected long-run nominal return on equity of 10% and an expected long-run inflation rate of 3%, ρ is 7%, and $(\rho/(1+\rho)) \approx 0.065$. Hence, after the qualifying date, the effective tax credit rate is only 6.5% of the legislated credit rate.

The legislated tax credit rates for the state JCTCs in our sample are computed in one of three ways, depending on the details of the enabling legislation,

$$\tau_{i,t}^{LEG} = \left\{ \tau_{i,t}^{WAGES}, \tau_{i,t}^{WITHHOLD}, \tau_{i,t}^{DOLLAR} \right\}. \qquad (21)$$

In most JCTC states, the legislation explicitly provides a tax credit rate as a fraction of the new hire's annual wages ($\tau_{i,t}^{WAGES}$). This rate is taken directly from the legislation. In other JCTC states, the legislation specifies a rate based on the new hire's income tax withholdings ($\tau_{i,t}^{WITHHOLD}$). We estimate this tax credit rate as the product of the rate in the legislation and average income tax withholding in a state-year, the latter calculated as the product of average annual manufacturing wage and the statutory personal income tax rate (for the income bracket corresponding to that annual wage) in that state-year. The wage data are obtained from the Annual Survey of Manufacturers Geographic Area Statistics. In a third set of JCTC states, as well as the federal JCTC in President Obama's proposed (but not adopted) American Jobs Act of 2011, the legislation specifies an annual dollar tax credit per new employee. We compute the associated tax credit rate ($\tau_{i,t}^{DOLLAR}$) as the dollar tax credit in the legislation divided by average annual wages in a state-year. For five of the 23 credits in our sample, the tax credit value is determined by a state agency or committee on an employer-by-employer basis. Unfortunately, these states do not routinely report both the tax expenditures and the incremental jobs or wages claimed by companies that used the credits, which would be needed to compute an average credit value. While we must thus exclude these states from our estimation of the user cost of labor elasticity, a robustness test in Section 6B, based on using only a credit indicator variable, documents that the omission of these five states does not appear to importantly affect our empirical estimates.

For some of the state JCTCs, firms can take the credit for multiple years as long as the new hire (or more accurately, the incremental addition to the firm's level of employment) is retained. In those cases, we compute the present discounted value of this stream of yearly credit amounts based on the number of years for which the firm gets the credit.

We also adjust the effective legislated tax credit rate for the number of eligible firms. JCTCs are granted only for firms that are not contracting, and we multiply $\tau_{i,t}^{LEG}$ in equation (20c) by one minus the fraction of establishments that are ineligible for a JCTC, the latter determined by plant closings or employment reductions. Data by state and year on this fraction was obtained from the Bureau of Labor Statistics.

3. The General Design[16]

As mentioned above, 23 states have or have had a broad JCTC with little or no restrictions on eligible industries and little or no restrictions on eligible geographic areas within the state.[17] Focusing on a broad-based tax credit allows us to avoid the distorting effects of a "stigma" that accompanies targeted tax credits, as employers may use the availability of a targeted credit as a signal of unobservable labor productivity (Bartik, 2001, Chapter 8 and Katz (1998)). In addition, our primarily empirical objective is to assess the ability of job creation tax credits to impact aggregate employment; narrowly targeted credits are much less likely to have an economically meaningful impact on aggregate employment. The details of these tax credits vary widely, but their basic designs are quite similar.

These tax credits are intended to subsidize net job creation by businesses. That is, only new jobs that expand a business' total payroll employment level qualify for the tax credit. With many state JCTCs, a firm can only claim the credit if the number of jobs and/or wages associated

[16] This description is based largely on the information provided in Wilson and Notzon (2009).

[17] Georgia is an exception because only jobs in manufacturing are eligible for the credit. Results presented in Section 6 do not suggest any anomalous behavior. California and New Jersey have extremely narrowly targeted JCTC, and they were excluded from our dataset.

with new jobs are above specified thresholds and meet certain other requirements, such as providing health insurance. In order to target net job creation instead of gross job creation, the thresholds are defined on a "rolling basis" – the initial threshold is based on previous levels of employment or wages and future thresholds are increased to reflect recent hires – in all but one state (Rhode Island with its 1995-97 temporary JCTC with a fixed base). Some states offer multiple tax credit rates that increase with the number of, or wages associated with, the added jobs.

State JCTCs differ with regard to how many years a business can apply the credit for a given hire against taxable income. Multi-year credits are intended to encourage future job retention in addition to current job creation. Similarly, most states require partial payback of the credit if the business' employment if the net new job(s) associated with the credit are not maintained for a specified length of time (i.e., if the business' employment level falls below the threshold on which the credit was based).

JCTCs are valuable even if a firm has no current tax liability. Very few JCTCs are refundable (receipt of a payment from the state even if there is no current tax liability). However, many JCTCs have carry-back/carry-forward provisions (the use of a current year credit to reduce past or future tax liabilities). Our initial empirical evidence in Section 2 suggests that refundability has a positive impact on employment growth.

B. Employment And Other Data

The empirical work reported here is based on monthly, seasonally adjusted, private non-farm employment data for the period January 1990 to September 2009. The earlier date is the first month in which these data are published. The latter date is chosen because it is the latest month (when the data were being compiled) that reflects information from state administrative records (based on unemployment insurance) and is no longer subject to revisions by the Bureau of Labor Statistics. This time span provides at least twelve months prior to and after each of the 22 credits in our sample.

A description of the construction and sources for the two control variables ($\Delta L^{P}_{i,t} / L^{P}_{i,t-1}$ and $COMPETITION_{i,t}$) in the employment growth equation will be presented in Section 5.C and the political ($REPUBLICAN_{i,t}$), tax competition ($COMPETITION_{i,t}$), and user cost ($UCC_{i,t}$) variables in the JCTC adoption decision equation in Section 5.A. Brief descriptions can be also found in the Glossary.

5. Empirical Preliminaries And Specification Issues

Before analyzing the impact of JCTCs on employment growth in Section 6, we first study the JCTC adoption decision and determine the statistical properties of the employment data. These results inform our specification of the estimating equation in sub-section C.

A. Understanding JCTC Adoption

Apart from developing a better general understanding of JCTCs, analyzing the adoption decision is useful for assessing the importance of an endogeneity bias potentially affecting our estimates of the JCTCs' employment growth effects. It is possible that shocks affecting a state's recent employment growth will influence the adoption of a JCTC. In particular, weak employment growth might make it more likely that JCTC legislation will be enacted and, with serial correlation in employment growth, estimates of the effectiveness of the JCTC may be biased downward. To assess the potential importance of this channel of influence, we estimate the following logit equation ($\Phi\{.\}$) containing lagged employment growth and controls,

$$\text{PROB}\{D_{i,t}^{\text{Signing}} = 1\} = \Phi\left\{\text{LGROWTH}_{i,t}, \text{REPUBLICAN}_{i,t}, \text{COMPETITION}_{i,t}, \text{UCC}_{i,t}, u_{i,t}\right\}, \tag{22}$$

where $D_{i,t}^{\text{Signing}}$ is an indicator variable for the signing date in state i at time t, PROB[.] is the probability that $D_{i,t}^{\text{Signing}} = 1$, $\text{LGROWTH}_{i,t}$ is employment growth defined below in several different ways, $\text{REPUBLICAN}_{i,t}$ is an indicator variable measuring the strength of Republican influence in state government, $\text{COMPETITION}_{i,t}$ is the fraction of bordering states with JCTCs, $\text{UCC}_{i,t}$ is the user cost of business capital, and $u_{i,t}$ is an error term containing a white-noise component and a state fixed effect. Since there are likely a number of factors determining JCTC adoption not included in equation (22), we believe that it is important to control for a time-invariant element of state-specific factors. With state fixed effects, consistent estimation is possible with a logit model but not a probit model (Cameron and Trivedi, 2005, Section 23.4).

Logit estimates of equation (22) are presented in Table 3. Since assessing the role of employment growth is the primary purpose of this exercise, we measure employment growth ($LGROWTH_{i,t}$) four different ways: employment growth in state i over the prior 12 months ($LGROWTH_{i,t}^{12}$), this growth rate relative to the average employment growth rate in the states bordering state i ($LGROWTH_{i,t}^{12,Bordering}$), and the same two variables computed over the prior 24 months. In each case, the coefficient reported in Table 3 is small and statistically insignificant (at conventional levels). There is no evidence indicating that employment growth influences JCTC adoptions.

A similar result is obtained regarding political parties. As expected, Republican control of the state government makes JCTC adoption less likely, though the results are both statistically and economically insignificant.

By contrast, JCTC adoptions are influenced positively by competition from tax policies of bordering states ($COMPETITION_{i,t}$) and negatively by changes in own-state business capital tax policy ($UCC_{i,t}$). The latter result suggests that business tax policies are considered as a package that encompasses both a reduction of business capital taxes and the adoption of JCTCs (Wildasin, 2007). Both coefficients are statistically significant regardless of the definition of employment growth. The relatively large coefficients on $UCC_{i,t}$ reflect the units in which the user cost is measured.

In sum, the results in Table 3 suggest that JCTC are adopted as longer-term tax policy measures in response to a general desire to cut business taxes and that they do not appear to be a short-term, countercyclical policy responding to anemic employment. This interpretation is also consistent with the evidence in Charts 3 and 4 and the nature of state JCTCs, which are either permanent or were not set to expire for many years.

B. Properties of the Monthly Employment Data

The statistical properties of the employment data are important for a proper specification of an econometric equation relating employment to JCTCs. With a particular interest in examining the persistence properties of the series, we estimate the following two models,

$$\ln\left\{L_{i,t}\right\} = \tilde{A}_i + \tilde{B}_t + \sum_{j=-12}^{12} \tilde{C}_j \, D_{i,t-j}^{Effective} + \sum_{j=1}^{24} \tilde{\psi}_j \ln\left\{L_{i,t-j}\right\} + \tilde{u}_{i,t} \qquad (23)$$

$$\Delta L_{i,t} / L_{i,t-1} = A_i + B_t + \sum_{j=-12}^{12} C_j \, D_{i,t-j}^{Effective} + \sum_{j=1}^{24} \psi_j \, \Delta L_{i,t-j} + u_{i,t} \,, \qquad (24)$$

$$\tilde{\Psi}_J \equiv \sum_{j=1}^{J} \tilde{\psi}_j \,, \qquad \tilde{u}_{i,t} = \tilde{r}_i \; \tilde{u}_{i,t-1} + \tilde{\varepsilon}_{i,t} \,, \qquad (25a)$$

$$\Psi_J \equiv \sum_{j=1}^{J} \psi_j \,, \qquad u_{i,t} = r_i \; u_{i,t-1} + \varepsilon_{i,t} \,, \qquad (25b)$$

where $L_{i,t}$ is the level of employment for state i in time period t, $\ln\{.\}$ is the logarithmic operator, $\Delta L_{i,t} / L_{i,t-1}$, is the growth rate in employment, A_i, B_t, C_j, ψ_j, and r_i (and the kindred parameters with a "$\sim$") are parameters to be estimated. $D_{i,t-j}^{Effective}$ is an indicator variable taking a value of 1 in the month when the JCTC becomes effective, which is the latter of the signing and qualifying months. The coefficients on this indicator variable identify the increase or decrease in employment growth during the first month in which businesses BOTH know that a credit has been enacted (i.e., signed into law) and can start making qualifying hires (i.e., after the qualifying date). Twelve leads and lags of $D_{i,t-j}^{Effective}$ are included in equations (23) and (24), in addition to its contemporaneous value. Lagged dependent variables are entered for up to J = 24 months and are parameterized by the individual ψ_js and their sum over J periods, Ψ_J. Inclusion of the lagged dependent variable accounts for possible persistence in employment.

The results of estimating the log levels equation (23) for various values of J are presented in Table 4, Panel A.[18] When J = 1, the value of $\Psi_1 = \theta$ (column 2) is close to 1.0. For additional lags of the dependent variable (larger values of J), Ψ_J is greater than one, and the log levels equation would not appear to be a suitable specification for employment.

Panel B contains estimates of the growth rate equation (24). Even for J = 1, serial correlation is absent (cf. columns 6 and 7) and the sums of coefficients on the lagged dependent variables in column 2 are close to zero for small values of J. For larger values of J, the coefficient on the additional lagged dependent variable becomes statistically significant, but the near constancy of the R^2s suggests that there is little additional explanatory power provided by more lags. The results in Table 4 strongly suggest that employment is best modeled as a simple growth rate.

This initial conclusion is confirmed by a formal unit root test. To assess stationarity, we use the panel unit root test recently proposed by Pesaran (2007) that extends the standard augmented Dickey-Fuller test to allow for cross-sectional dependence. For the log level of employment, we estimate the following auxiliary equation,

[18] Results for only 12 lags ($J \leq 12$) are reported in Table 4. The results are robust for $13 \leq J \leq 24$.

$$\Delta L_{i,t} / L_{i,t-1} = a_i + b_i \ln\left\{L_{i,t-1}\right\} + \bar{b}_i \bar{L}_{t-1} + \sum_{j=1}^{J'} d_{i,j} \Delta L_{i,t-j} + \sum_{j=0}^{J'} \bar{d}_{i,j} \overline{\Delta L}_{t-j} \quad (26a)$$

$$+ g_i t + u_{i,t},$$

$$u_{i,t} = r_i u_{i,t-1} + \varepsilon_{i,t}, \quad (26b)$$

$$\mu_b = \sum_{i=1}^{48} b_i / 48, \quad (26c)$$

where the critical values for μ_b are provided in Pesaran's Tables II.b and II.c for tests without and with a time trend ($g_i t$ in the above equation), respectively. The lag length for the lagged dependent variable (J') is determined by the need to absorb any serial correlation in the errors. The estimated values of μ_b are well below these critical values and serial correlation is absent. This test indicates that the monthly series for $\ln\left\{L_{i,t}\right\}$ has a unit root and confirms that employment is best modeled as a growth rate.

Taken together, the results presented in Section 5.A and 5.B indicate that an estimating equation with employment growth as the dependent variable and a measure of JCTCs as an independent variable will deliver consistent parameter estimates.

C. Specification Of The Estimating Equation

With these conclusions in mind, we relate employment growth to JCTCs and other determinants in the following equation,

$$\Delta L_{i,t} / L_{i,t-1} = -\gamma * F\left[JCTC_{i,t}\right] + \kappa * (\Delta X_{i,t} / X_{i,t-1}) + u_{i,t}, \quad (27)$$

where $F\left[JCTC_{i,t}\right]$ is a general function capturing the effects of changes in the JCTC on the effective wage and, through γ (> 0), on employment growth, $X_{i,t}$ represents control variables,

$u_{i,t}$ is an error term that contains several components (discussed below) and κ and γ are parameters to be estimated. Equation (27) is not a first-order condition from a structural model and γ should not be interpreted as a structural parameter. Rather, γ is an average treatment effect measuring the impact of the tax credit. The object of our analysis is to generate consistent estimates of γ for several intervals and across two regimes.

We consider each of the right-side terms in turn. The $F\left[JCTC_{i,t}\right]$ variable is defined in three different ways reflecting finer measures of the impact of the tax credit. The coarsest measure is an indicator variable, $F^1\left[JCTC_{i,t}\right]$, taking the value of 1 in those periods when the JCTC is relevant to the firm. While this measure of the effects of the JCTC relies on a minimal number of auxiliary assumptions, it does not account for variation across states in the value of the tax credit. Our second measure recognizes this variation by multiplying the indicator variable by the legislated value of the tax credit. In this case, $F^2\left[JCTC_{i,t}\right] = \tau_{i,t}^{LEG}$; note that this variable will be 0 during those periods when the JCTC is not relevant. As indicated by the theoretical model, there are subtle relations between the JCTC and its ultimate incentive effects. In particular, the negative incentives in the BEFORE interval for delayed JCTCs is not captured by $F^2\left[JCTC_{i,t}\right]$, though this issue does not affect the estimation of the other γ coefficients in this regression. Our third definition captures these incentive effects as represented by the first-order conditions (equations 19) describing the relation between the <u>level</u> of employment and the JCTC. For the employment growth equation, we compute the logarithmic time differences of these first-order conditions. (An explicit derivation is contained in Appendix W, not included in this draft.) We further assume that variations in JCTCs have no effect on the gross-of-JCTC wage rate and that the non-JCTC induced variation in the wage rate is captured by the time and state fixed effects. Since the JCTC affects employment growth through the effective wage rate (which has a negative incentive effect), we multiply the logarithmic differences by minus one. The resulting regressors for the Delayed Regime are as follows[19],

$$\begin{aligned} F^{3,BEFORE}\left[JCTC_{i,t}\right] &= -\tau_{i,t}^{LEG} / \left(1+\rho\right), \\ F^{3,AT}\left[JCTC_{i,t}\right] &= \tau_{i,t}^{LEG}, \\ F_3^{3,AFTER}\left[JCTC_{i,t}\right] &= 0 . \end{aligned} \tag{28}$$

The comparable entries for the Immediate Regime are as follows,

$$\begin{aligned} F^{3,AT}\left[JCTC_{i,t}\right] &= \tau_{i,t}^{LEG} * \left(\rho / (1+\rho)\right) \\ F_3^{3,AFTER}\left[JCTC_{i,t}\right] &= 0 \end{aligned} \tag{29}$$

The second right-side term in equation (27) represents two control variables included in the baseline model. One way to control for overall demand conditions in the state and avoid endogeneity problems is to include a measure of the state's exposure to particularly fast-growing or slow-growing industries. For example, even in absence of any employment-inducing fiscal policies, a state with a large IT industry during the late 1990s was likely to experience rapid employment growth during that period. One way to control for industry-driven employment changes is to first predict a state's year-over-year employment growth rate by calculating a weighted-average across industries of the national (excluding own-state) employment growth rates (year-over-year), where the weights are the state's employment shares in each industry. Multiplying this predicted annual growth rate by the level of own-state employment in period

[19] For the purposes of exposition, we show here the first-order Taylor approximations of the logarithmic differences rather than the full (messier) expressions of the logarithmic differences. We compute the regressors using the full expressions, which are shown in Appendix W (not included in this draft).

t - 12 yields a predicted level of employment in period t. This "predicted" employment variable, $L^{P}_{i,t}$, was introduced by Bartik (1991) and is frequently referred to as the "Bartik mix variable." If the state is small relative to the nation, then this variable will not be correlated with the error term. Given that our empirical model is stated in terms of monthly growth rates (based on the tests in Section 5.B), we therefore add the monthly growth rate of this predicted employment variable, $\Delta L^{P}_{i,t} / L^{P}_{i,t-1}$, to our baseline specification.

A second control variable is suggested by the logit results. Section 5.A documented that the adoption of a JCTC is positively influenced by JCTCs in effect in bordering states. Since one of the underlying channels of influence may be the effect of bordering state JCTCs on in-state employment, we control for this possible effect by including $COMPETITION_{i,t}$ as an additional control variable. While these two control variables would seem relevant, we recognize that some relevant variation in employment growth will remain and become part of the error term.

The third right-side variable in equation (27) is the error term modeled as follows,

$$u_{i,t} = \alpha_i + \beta_t + LT_{i,t} + \varepsilon_{i,t}, \tag{30}$$

α_i is a state-specific effect (for the employment growth rate), β_t is a time fixed effect, $LT_{i,t}$ is a state-specific local time trend (local to a specified window of time around the JCTC adoption date; see the Glossary for details about the construction of $LT_{i,t}$), and $\varepsilon_{i,t}$ is a white noise error term.

Substituting equations (29) and (30) into equation (27) and inserting the two control variables, we obtain the following estimating equation,

$$\Delta L_{i,t} / L_{i,t-1} = \gamma\, JCTC_{i,t} + \kappa_1 \left(\Delta L^P_{i,t} / L^P_{i,t-1}\right) + \kappa_2\, COMPETITION_{i,t} + \alpha_i + \beta_t + LT_{i,t} + \varepsilon_{i,t}\,, \tag{31}$$

where the 25 non-JCTC states serve as the control group.

Equation (31) is appropriate for examining the contemporaneous effects of the adoption of JCTC homogeneous across states and quantifying its impact on employment growth by the estimated γ parameter. However, the multiple intervals (BEFORE, AT, AFTER-EARLY, and AFTER-LATE) and multiple regimes (delayed or immediate) complicate estimation. Consequently, the $\gamma\, JCTC_{i,t}$ term in equation (31) needs to be expanded in several dimensions. For example, if we are interested in the both the month at which the JCTC is adopted (the "At" interval) and the interval before adoption (the "Before" interval) that extends for J^{Before} months, then the $\gamma\, JCTC_{i,t}$ term is replaced by the following expanded expression,

$$\gamma\, JCTC_{i,t} \;\rightarrow\; \sum_{j=1}^{J^{Before}} \gamma_j^{Before} JCTC_{i,t+j} + \gamma^{At} JCTC_{i,t} \tag{32}$$

In principle, we would like to estimate a γ_j^{Before} coefficient for each month in the before interval. However, there are far too few JCTC adoptions to estimate these monthly parameters with any precision. Thus, we replace the series of monthly γ_j^{Before} s with one γ^{Before} for the before interval,

$$\gamma\, JCTC_{i,t} \;\rightarrow\; \gamma^{Before} \sum_{j=1}^{J^{Before}} JCTC_{i,t+j} \;+\; \gamma^{At} JCTC_{i,t} \tag{33}$$

As discussed in the theory section, we are also interested in the impact of JCTCs after adoption, and expression (33) is expanded to include two more intervals, "After-Early" and

"After-Late" that extend for $J^{After-Early}$ and $J^{After-Late}$ months, respectively,

$$\begin{aligned} \gamma\,JCTC_{i,t} \;\rightarrow\; & \gamma^{Before}\sum_{j=1}^{J^{Before}} JCTC_{i,t+j} \;+\; \gamma^{At} JCTC_{i,t} \\ & + \gamma^{After-Early}\sum_{j=1}^{J^{After-Early}} JCTC_{i,t-j} \;+\; \gamma^{After-Late}\sum_{j=1}^{J^{After-Late}} JCTC_{i,t-j} \end{aligned} \tag{34}$$

The purpose of dividing the After interval into these two subintervals is to allow for the possibility thatthe initial response to the tax credit, which theoretically would occur only in the month defining the At interval, might spillover into the subsequent two or three months due to adjustment costs. The lengths of the After-Early and After-Late intervals are three and nine months, respectively.

The notation in equation (34) needs to be modified in two ways to reflect additional nuances in our data. First, the length of the Before interval is determined by the nature of each state's JCTC legislative history and, per the discussion in Section 4.A, the resulting "distance" between the signing and qualifying dates. Thus, we need to add an *i* subscript to J^{Before}. Second, equation (34) does not recognize that the responses of employment growth may differ across the two JCTC regimes – Delayed (Del) and Immediate (Imm). This differential sensitivity is apparent for γ^{Before}, which is zero by construction for immediate JCTC states but estimated freely for delayed JCTC states. Moreover, the theoretical model implies that γ^{At} should be relatively larger in delayed JCTC states where firms may have postponed hiring in anticipation of a future tax credit. To recognize these differential responses, we add *Del* and *Imm* subscripts to the γs and sum over states in the two distinct regimes,

$$\begin{aligned}
\gamma\,\mathrm{JCTC}_{i,t} \;\rightarrow\; & \sum_{i\in \mathrm{Del}}\left\{\gamma_{\mathrm{Del}}^{\mathrm{Before}}\sum_{j=1}^{J_i^{\mathrm{Before}}}\mathrm{JCTC}_{i,t+j} + \gamma_{\mathrm{Del}}^{\mathrm{At}}\mathrm{JCTC}_{i,t}\right\} \\
& + \left\{\gamma_{\mathrm{Del}}^{\mathrm{After-Early}}\sum_{j=1}^{J^{\mathrm{After-Early}}}\mathrm{JCTC}_{i,t-j} + \gamma_{\mathrm{Del}}^{\mathrm{After-Late}}\sum_{j=1}^{J^{\mathrm{After-Late}}}\mathrm{JCTC}_{i,t-j}\right\} \\
& + \sum_{i\in \mathrm{Imm}}\left\{\gamma_{\mathrm{Imm}}^{\mathrm{At}}\mathrm{JCTC}_{i,t}\right\} \\
& + \left\{\gamma_{\mathrm{Imm}}^{\mathrm{After-Early}}\sum_{j=1}^{J^{\mathrm{After-Early}}}\mathrm{JCTC}_{i,t-j} + \gamma_{\mathrm{Imm}}^{\mathrm{After-Late}}\sum_{j=1}^{J^{\mathrm{After-Late}}}\mathrm{JCTC}_{i,t-j}\right\}
\end{aligned} \tag{35}$$

In sum, equations (31) and (35) define the econometric equation that will generate the estimates reported in this paper.

6. Empirical Results

Tables 5 to 9 contain estimates of the expected impacts of JCTCs on employment growth for the four intervals in the Delayed Regime and the three intervals in the Immediate Regime. In all but one case, these impacts are the γ coefficients measuring the total effect of the JCTC in a given interval; the one exception is for the Before interval for the Delayed Regime, where the reported γ is multiplied by minus one to adjust for the increase in the effective wage rate due to anticipatory behavior.

Table 5 measures the impact of the JCTC by an indicator variable (cf. $F^1[.]$ discussed in Section 5.C). For the Delayed Regime, the Anticipatory Dip is evident (-0.551) and the response for the AT interval is much larger for the Delayed Regime relative to the Immediate Regime (0.180 vs. 0.068).

Table 6 performs the same regression with a reduced sample. The reduction is needed because our future results with a tax credit variable will have to be estimated on this sample. The results are robust when compared to Table 5. This reduced sample is used in Tables 7 and 8.

Table 7 measures the impact of the JCTC by the legislated JCTC (cf. $F^2[.]$ discussed in Section 5.C). The $F^2[.]$ variable recognizes this variation by multiplying the indicator variable by the legislated value of the tax credit. The results are again robust.

Table 8 measures the impact of the JCTC as determined by the theoretical model and displayed in equations (28) and (29) and reports our benchmark results. We begin in column (1) with the Delayed Regime. In the Before interval, employment growth falls in anticipation of future eligibility for the JCTC. When firms can first qualify for the JCTC (the At interval), employment growth is positive but not as large as the fall during the preceding Before interval. The γs for both After intervals are negative, indicating that employment growth falls immediately after the qualifying month. This fall is consistent with the predictions of our model (cf. Table 2) in which employment growth, after the initial boost in the At interval, falls as firms adjust to the reduction in the value of the credit due to the rolling base and as firms restock inventories. While these point estimates for the AFTER intervals are consistent with the implications of the theoretical model, the standard errors are large and, with the exception of the At interval, not statistically different from zero at conventional levels. Thus, we are hesitant to draw any firm conclusions on the quantitative importance of fiscal foresight and inventory drawdowns, though the results are suggestive of such effects.

The results for the Immediate Regime in column (2) provide a better "experiment" for assessing the true long-run impact of the JCTCs because they are not affected by fiscal foresight with the compensating change during the At interval. The elasticity of employment with respect to the effective credit rate at the qualifying date is 0.068. That is, a 1 percentage point higher effective credit rate – for instance, going from no credit to a credit with an effective rate of 1% – is associated with an increase in employment growth of only 0.068%.[20] A comparison of this elasticity to the comparable figure for the Delayed regime of 0.180 indicates that over 60% of the employment response for delayed JCTC states is a catch-up effect to correct for fiscal foresight and inventory drawdowns. In contrast to the results for the Delayed Regime, the coefficients for the Immediate Regime for the two After intervals are positive. The positive effect of JCTCs on employment growth in the months after the credits go into effect suggest that, despite the rolling base feature of the credits, there remains a small positive incentive for firms to grow employment.

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[20] The effective credit rate – that is, the credit rate adjusted for the rolling base feature and the fraction of eligible employers – averaged over immediate JCTCs is 0.69%. This corresponds to a roughly 10% unadjusted credit rate (0.69/(0.065*ELIGIBLE), where 0.065 is the rolling base adjustment and ELIGIBLE is the fraction of expanding employers and averages 0.93 for immediate JCTC states).

The effect on cumulative employment growth over all four intervals is 0.390 and can be interpreted as the effective JCTC elasticity of employment over the medium-run. It implies that a one percentage point higher JCTC, as would occur, for instance, from a state adopting a JCTC with an effective credit rate of 1% (equivalent to a statutory credit rate around 15%), would lead to 0.39% higher employment over this period.

B. Extensions

In this subsection, we consider two extensions: (1) whether JCTCs affects some industries more than others and (2) whether JCTC-induced increases in employment growth stem from faster employment growth among incumbent employers or from drawing jobs away from other states.

Because industries differ in their production technologies, the elasticity of employment with respect to a change in the user cost of labor might differ across industries for at least two reasons. First, the elasticity of substitution between capital and labor likely differs across industries. Second, different industries use different types of workers; in particular, some industries employ workers of highly elastic labor supply while others employ workers of relatively inelastic labor supply. For example, retail trade establishments tend to hire younger, lower-skilled individuals from an abundant and hence highly elastic labor pool. In contrast, industries like professional services tend to hire more experienced, higher-skilled individuals whose supply is relatively inelastic in the short-run. As discussed in Goolsbee (1998), subsidies that reduce factor prices stimulate higher quantities of those factors in the short-run only to the extent that their short-run supply elasticity is high.

Table 9 extends our baseline results, which were for private nonfarm employment, across industries. We produce results for all NAICS 2-digit “supersectors” within the private nonfarm sector for which seasonally-adjusted monthly employment data from the BLS are available for all 48 states in our sample. These supersectors are Retail Trade; Leisure and Hospitality; Trade, Transportation, and Utilities; Education and Health Services; and Professional Services and represent much less economic activity then the data used for our prior empirical results.

For Retail Trade and Leisure and Hospitality – two industries whose labor pool is likely to have especially elastic labor supply, the initial impact of delayed JCTCs is large and statistically significant while the initial impact of immediate JCTCs is quite small (and precisely estimated). Yet, as we found with total private nonfarm, the impact of the immediate credits in these industries grows over subsequent months and we find a statistically significant cumulative effect. The results are similar in the Trade, Transportation, and Utilities industry, though the impact of delayed JCTCs is a bit smaller. In these three industries, any positive initial effect of delayed JCTCs appears to be fully reversed in the long run as evidenced by the coefficient in the AFTER-LATE period (and small, insignificant effects in the AFTER-EARLY period). The results are quite different for Education and Health and for Professional Services. In those industries, there is no evidence of a positive jump in employment growth in the AT period for delayed JCTCs. In fact, for Professional Services, employment growth actually falls significantly on impact, though the effect is not economically large. For these industries, the initial impact of immediate JCTCs is positive but economically insignificant (though it is statistically significant for Professional Services). This impact grows over time for Professional Services, as it did for the first three industries, while it falls over time for Education and Health Services. A possible explanation for the negative effect of these credits in Education and Health Services is that these sectors are closely tied to the state government sector which might be cutting its own expenditures to compensate for the foregone tax revenues associated with the credits.

Our next extension deals with the possibility of interstate spillovers. Several pieces of evidence point toward state JCTCs as economic development tools. This conclusions leads to the question as to whether the increase in employment growth documented in Table 4 for the Immediate Regime is from in-state firms or reflects the relocation of economic activity and employment from other states. The answer to this question is of particular importance in using our results to inform discussions about a federal job tax credit. If an active relocation channel exists, then our estimates are an upper bound on the likely effect of a federal tax credit, which is immune to relocation effects.

To examine the latter channel, we begin with the residuals, $\varepsilon_{i,t}$, from our baseline model (equations (31) and (35)). These represent employment growth not accounted for by the variables included in the model. If the employment growth associated with a JCTC is largely coming at the expense of neighboring states, then we would expect the JCTC for state *i* to have a negative impact on residual employment growth from neighboring states. We test this proposition by forming for state *i* the spatial lag of the $\varepsilon_{i,t}$ s for neighboring-qua-bordering states, and run the following model,

$$S\left\{\varepsilon_{i,t}\right\} = \sum_{i \in Imm} \left\{ \begin{array}{l} \delta_{Imm}^{At} JCTC_{i,t} \; + \; \delta_{Imm}^{After-Early} \sum_{j=1}^{J^{After-Early}} JCTC_{i,t+j} \\ \\ + \; \delta_{Imm}^{After-Late} \sum_{j=1}^{J^{After-Late}} JCTC_{i,t+j} \end{array} \right\} + \nu_{i,t} \qquad (36)$$

where $S\{\varepsilon_{i,t}\}$ is a spatial lag operator that weights only the bordering states and $\nu_{i,t}$ is an error term. We focus on the immediate JCTC states since only they generated significant long-run results in the baseline model. Equation (36) generates little evidence of a relocation channel. Each of the three δ s is economically and statistically insignificant; the sum of the δ s is 0.014 with a standard error of 0.080 (p-value = 0.866). The lack of any "beggar thy neighbor" effect here is not surprising given our earlier findings of a small own-state effect of these credits.

7. Prior Literature and Policy Implications

A. Prior Literature

A job tax credit has been tried only once before at the U.S. federal level, the 1977-1978 "New Jobs Tax Credit" (NJTC). Sunley (1980) offers a detailed description of the convoluted policy discussions and legislative history surrounding the eventual enactment of the NJTC. It is particularly important to note that crucial details of the NJTC were not determined until the end of the process in the House/Senate Conference Committee and thus would have been difficult to anticipate. The NJTC offered corporations with taxable income a credit whose value was proportional to the increase in the corporation's net payroll employment level above 102% of its previous year's employment level.

The effectiveness of the NJTC has been discussed in three studies. Using survey data in a cross-section regression, Perloff and Wachter (1979) find that firms that reported knowing about the credit experienced 3% higher employment growth than other firms. Bishop (1981) also studies the employment effects of the NJTC but with time series data for several industries likely to be responsive to the NJTC. He reports that the NJTC increased employment in the

Construction, Trucking, Wholesale, and Retail sectors in 1977-1978 by between 0.66% and 2.95%. As in the Wachter study, the effects of the NJTC are measured by a variable reflecting the percentage of firms aware of the tax credit. By contrast, Sunley (1980, p. 408) concludes that the effects of the NJTC were "slight" because of the complexity of the law and delays between hiring decisions by firms and eligibility determination by regulators.

There are three other studies that have quantified the effects of marginal tax credits.[21] Kesselman, Williamson, and Berndt (1977) estimate a translog cost function and report that, for equal revenue costs and hypothetical policies, the percentage increase in employment from a marginal employment tax credit is about twice as great as the comparable increase from a uniform employment tax credit. Faulk (2002) examines an incremental job tax credit in Georgia. With cross-section data, she estimates separate employment equations for eligible firms that are participating or non-participating in the Georgia program and a probit selection equation to determine participation. For those eligible firms participating in the program, employment rose by between 23 to 28 percent. The cost was between $2,280 and $2,680 per job created.

More recently, Bartik and Bishop (2009) undertake a detailed simulation exercise of a refundable JCTC valued at 15% of the wage cost of new employment in 2010 and 10% in 2011. They conclude that the cost per job would be $4,656 in 2010 and $6,301 in 2011. There analysis is particularly useful in explicitly stating the assumptions underlying the computations. There are three key assumptions in their analysis: (1) the wage elasticity of labor demand (the larger the elasticity, the lower the cost per job); (2) the increase in GDP induced by the tax credit

[21] Fethke, Policano, and Williamson (1978) discuss several conceptual issues concerning employment tax credits.

(the larger the multiplier, the lower the cost per job);[22] and (3) the number of jobs that generate tax credits even though they would have been created sans the JCTC (the smaller inframarginal job growth, the lower the cost per job).

B. Policy Implications

Our estimates are useful for analyzing the impact of President Obama's recent proposal of a $4,000 federal JCTC for long-term unemployed workers. For the average worker, this corresponds to about a 10% reduction in one year's wages. However, as indicated in equation (10), the effective JCTC is the product of this change, the adjustment for the rolling base aspect of the state JCTCs in our sample (0.065), and eligibility (0.94). Thus, the effective decline in wage costs is 0.6%. Multiplying this figure by our elasticity of 0.35, we obtain an increase in employment of 0.2%, which corresponds to about 280,000 workers or a reduction in the unemployment rate of 0.1 percentage points.

There are two factors that are determining this modest outcome. The policy initiative is relatively small because of the rolling base feature or, equivalently, because a partial reduction in one year's wages is very small when compared to the total wage cost over the expected employment relationship. And the response to this modest stimulus of 0.35% (cf. Table 4) is also relatively small.

8. **Conclusions**

This paper uses the experience of 23 U.S. states to inform policy discussions about the efficacy of job creation tax credits (JCTCs). The relevant legislative dates for all state JCTCs that have been passed in the U.S. since 1990 are compiled. We develop a theoretical model that

[22] Regarding fiscal multipliers, see Wilson (2010) and the articles in the September 2011 issue of the *Journal of Economic Literature*.

captures the effects the rolling base feature of JCTCs and shows that this feature is quantitatively very important. The theoretical model also delivers a set of empirical predictions that are evaluated in an event study framework.

Our econometric estimates lead to several preliminary conclusions. The state JCTCs are not a countercyclical tool adopted to raise anemic employment. Rather, they appear to be economic development policies. Fiscal foresight (intertemporal behavior that runs counter to policy objectives) is found in the data, though the result is imprecisely estimated. The JCTC elasticity of employment is found to be small. We use this estimate to evaluate President Obama's recently proposed JCTC and, in part because the stimulus is small and in part because the elasticity is small, conclude that it would have a modest impact on the labor market, creating 280,000 more jobs and lowering the unemployment rate by 0.1 percentage points.

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Glossary -- Incomplete

$\text{COMPETITION}_{i,t}$. Fraction of bordering states with JCTCs over the prior 12 months: $= \sum_{j=1}^{48} \omega_{j,i}^{\text{Bordering}} \text{ACTIVE}_{j,t}^{\text{JCTC}} / B(i)$, $\omega_{j,i}^{\text{Bordering}} = 1$ if state j borders state i, $\omega_{j,i}^{\text{Bordering}} = 0$ otherwise; $\text{ACTIVE}_{j,t}^{\text{JCTC}} = \text{MAX}\left\{0, D_{j,t-m}^{\text{SIGNING}} \text{ for } m = 1, 12\right\}$, $B(i)$ is the number of states that border state i.

$D_{i,t}^{\text{Effective}}$. An indicator variable taking the value of 1 in the month when the JCTC becomes effective ($t = t_i^{\text{Effective}}$), which we identify as the latter of the signing and qualifying months; 0 otherwise. This indicator variable will be 0 for all t for the 25 states without a JCTC.

$D_{i,t}^{\text{LT}}$. An indicator variable for the local trend taking the value of 1 for the 12 months before, at, and the 12 months after the qualifying month ($t_i^{\text{Qualifying}}$), 0 otherwise: $= \left(D_{i,t}^{\text{Window,Pre-Effective}} + D_{i,t}^{\text{Effective}} + D_{i,t}^{\text{Window,Post-Effective}}\right)$, where these three indicator variables are defined elsewhere in this Glossary.

$D_{i,t}^{\text{Qualifying}}$. An indicator variable taking the value of 1 in the JCTC qualifying month ($t = t_i^{\text{Qualifying}}$); 0 otherwise. This indicator variable will be 0 for all t for all states without a JCTC .

$D_{i,t}^{\text{Signing}}$. An indicator variable taking the value of 1 in the JCTC signing month ($t = t_i^{\text{Signing}}$), 0 otherwise. This indicator variable will be 0 for all t for the 25 states without a JCTC.

$D_{i,t}^{\text{Window,Post-Effective}}$. An indicator variable taking the value of 1 in a 12 month window after the JCTC qualifying month, $t_i^{\text{Qualifying}} < t \le t_i^{\text{Qualifying}} + 12$, 0 otherwise.

$D_{i,t}^{\text{Window,Pre-Effective}}$. An indicator variable taking the value of 1 in a 12 month window before the JCTC qualifying month, $t_i^{\text{Qualifying}} - 12 \le t < t_i^{\text{Qualifying}}$, 0 otherwise.

Fiscal foresight. The phenomenon whereby economic agents know with probability 1 that a JCTC will go into effect on a known date in the future. This situation only occurs during the period between the signing date and the qualifying date for credits with implementation periods. Also known as "Ashenfelter Dips." See line segment AB in Chart 4.

i: An index for state i.

Implementation Interval. Interval between signing and qualifying months when $t_i^{Signing} < t_i^{Qualifying}$.

Implementation Regime (I). A JCTC with an implementation period.

Inventory overshooting effect. JCTC-induced response of employment that occurs on the effective date and reflects the accumulation of inventory that compensates for prior draw downs and/or reflects intertemporal substitution in the face of temporarily lower labor costs. Line segment DE in Chart 4.

$INELIGIBLE_{i,t}$. The fraction of establishments that are ineligible for a JCTC because of plant closings or employment reductions. Source: xx.

$L_{i,t}$. The level of employment. Source: xx

$LGROWTH_{i,t}$. Employment growth over some number of prior months. This variable is defined in four different ways. See Table 2 for details.

$LGROWTH_{i,t}^{N}$. Employment growth over the prior N months: $= (L_{i,t} - L_{i,t-N}) / L_{i,t-N}, \ N = 12, 24$. For N = 1, $LGROWTH_{i,t}^{1} = \Delta L_{i,t} / L_{i,t-1}$

$LGROWTH_{i,t}^{N,Bordering}$. Employment growth in the states bordering state i over the prior N months: $= (L_{i,t}^{Bordering} - L_{i,t-N}^{Bordering}) / L_{i,t-N}^{Bordering}, \ N = 12, 24; \ L_{i,t}^{Bordering} = \sum_{j=1}^{48} \omega_{j,i}^{Bordering} L_{j,t}$

$\omega_{j,i}^{Bordering} = 1$ if state j borders state i, $\omega_{j,i}^{Bordering} = 0$ otherwise.

Long-run effect ("True"). The JCTC-induced response of employment between the time the tax credit becomes effective ($t_i^{Effective}$) and one year later ($t_i^{Effective} + 12$). Line segment CF (equal to line segment AF) in Chart 4.

$L_{i,t}^{P}$. "Predicted" employment: a weighted-average across industries of the national (excluding own-state) employment growth rates (year-over-year), where the weights are the state's employment shares in each industry. Multiplying this predicted annual growth rate by the level of own-state employment in period t - 12 yields a predicted level of employment in period t.

$LT_{i,t}$. A local trend defined for the 12 months prior to the earlier of the signing and qualifying date to 12 months after the later of the two dates: $= \hat{\lambda}_i D_{i,t}^{LT}$, where $D_{i,t}^{LT}$ is an indicator variable and $\hat{\lambda}_i$ is the local employment growth rate (defined elsewhere in this Glossary) and t indexes time. Since this component of the error term is pre-set, we subtract $LT_{i,t}$ from the dependent variable prior to estimation of equations (29) and (33).

$\hat{\lambda}_i$. Is the local employment growth rate defining the local trend ($LT_{i,t}$). Estimation of λ_i over the entire 25 month window would be problematic because part of the effect of the JCTC would be reflected in this estimate, thus attenuating the estimated γs. To avoid this problem, we assume that the local trend (in employment) is constant over the 25 month window. We then estimate $\hat{\lambda}_i$ from the residuals in the Pre-Effective period from an equation similar to equation (29) without the JCTC variables. This estimated $\hat{\lambda}_i$ is used for the Pre-Effective, Effective, and Post-Effective periods.

Rebound effect. JCTC-induced response of employment that occurs on the effective date and compensates for the anticipation effects. Line segment BC in Chart 4. Note that Point C has the same value as Point A.

$REPUBLICAN_{i,t}$. An indicator variable taking the value of 1 if both the governorship and the legislature are Republican controlled, a value of 1/2 if only one of these elected bodies is Republican controlled, and 0 if neither of these elected bodies are Republican controlled. Source: xx.

Short-run effect ("True"). JCTC-induced response of employment that occurs on the effective date, net of the rebound effect. Line segment CD in Chart 3.

Signing date/month (t_i^S). Date/month at which the governor in state i officially signs or enacts JCTC legislation into law.

t. An index for time measured in months.

$t_i^{Effective}$. Effective month for the JCTC defined as the later of the signing and qualifying months: $t_i^{Effective} = MAX\left\{t_i^{Signing}, t_i^{Qualifying}\right\}$.

$t_i^{Qualifying}$. Qualifying month for the JCTC; the earliest month a new hire may qualify for a JCTC. Source: Authors' compilation.

$t_i^{Signing}$. Signing month for the JCTC. Source: Authors' compilation.

$\tau_{i,t}$. The rate of a Job Creation Tax Credit. Source: see discussion in Section 3.

$UCC_{i,t}$. The user cost of capital that measures the nominal incentive effects due to business capital taxes.

$UCL_{i,t}$. The user cost of labor that measures the incentive effects due to JCTCs: $W_{i,t}(1-\tau_{i,t})$.

$W_{i,t}$. The nominal wage rate.

**Chart 1: Number Of States That Have Enacted A JCTC
January 1990 To August 2009**

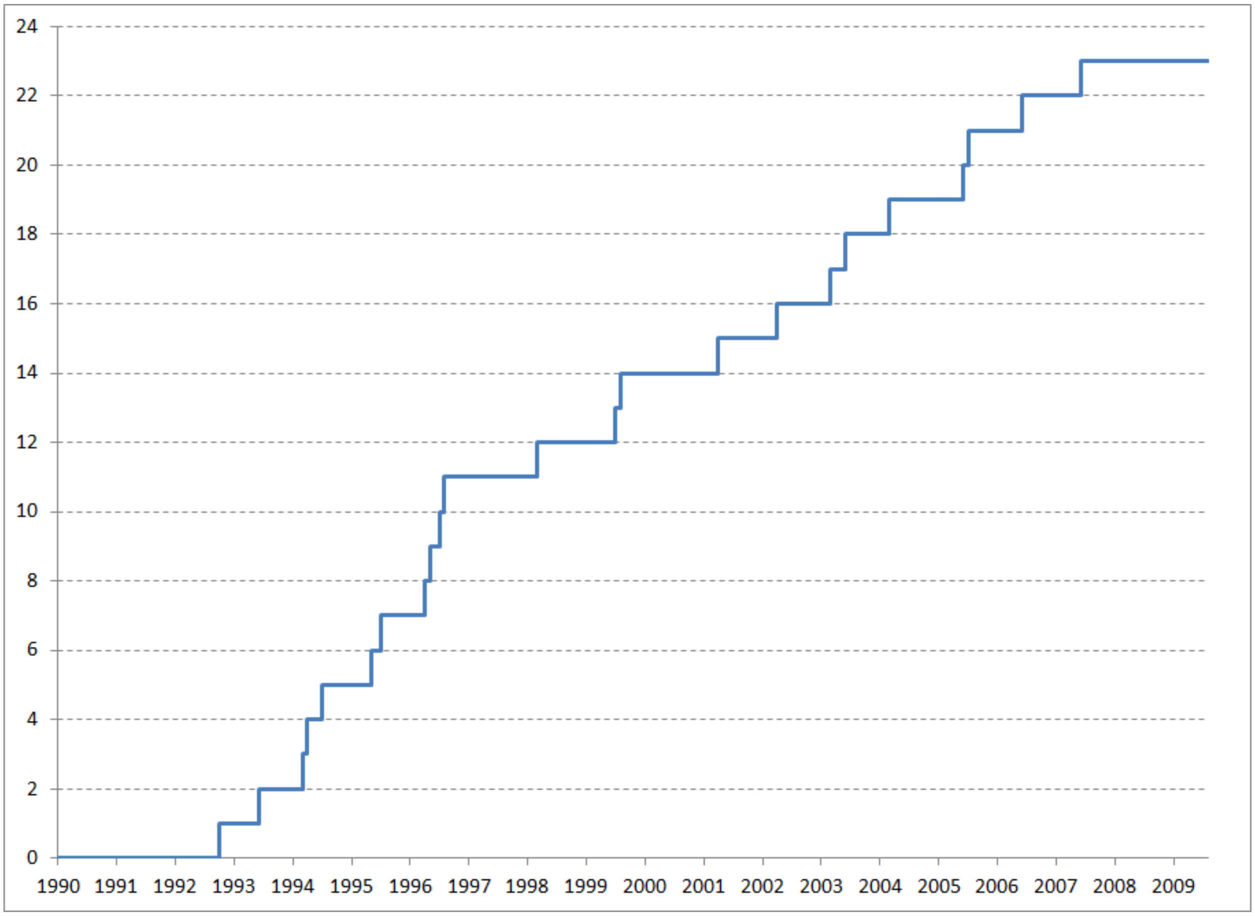


Chart 2: Map Showing States That Have Had a JCTC As Of August 2009

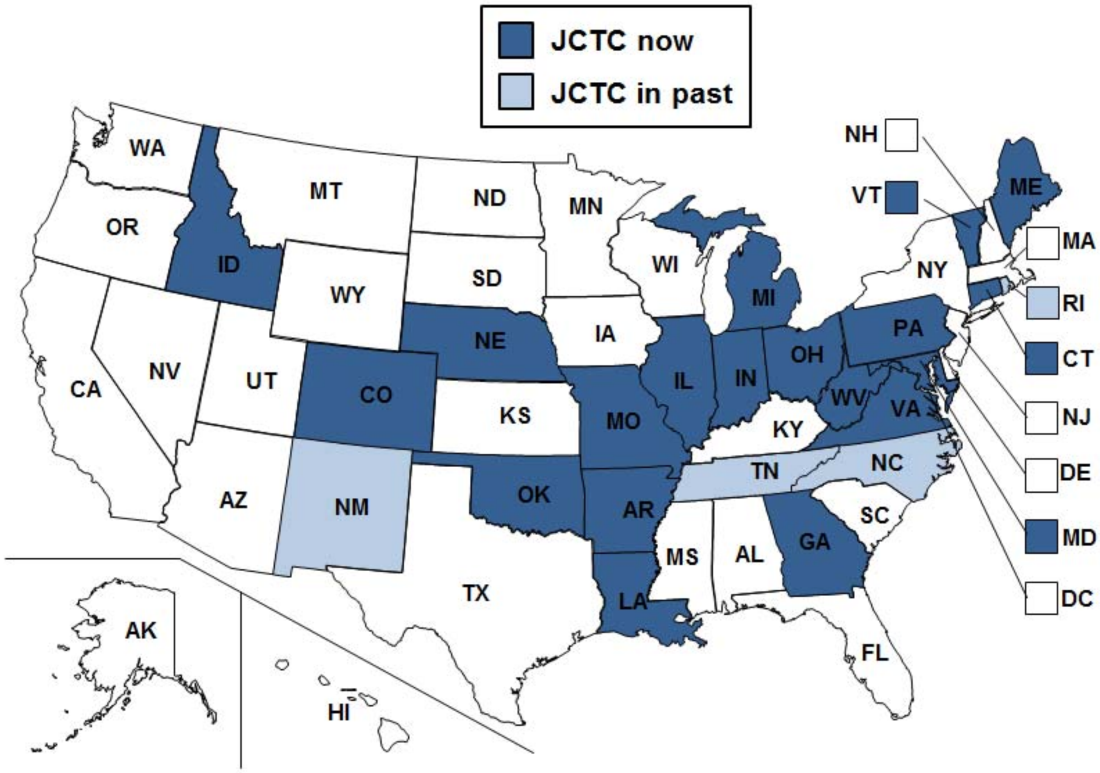
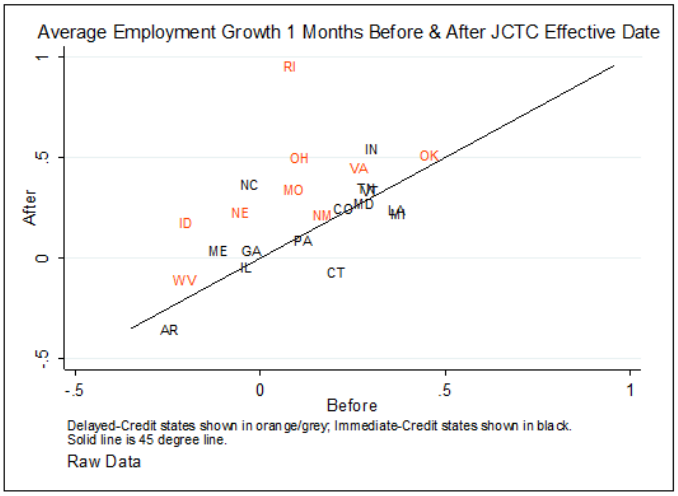
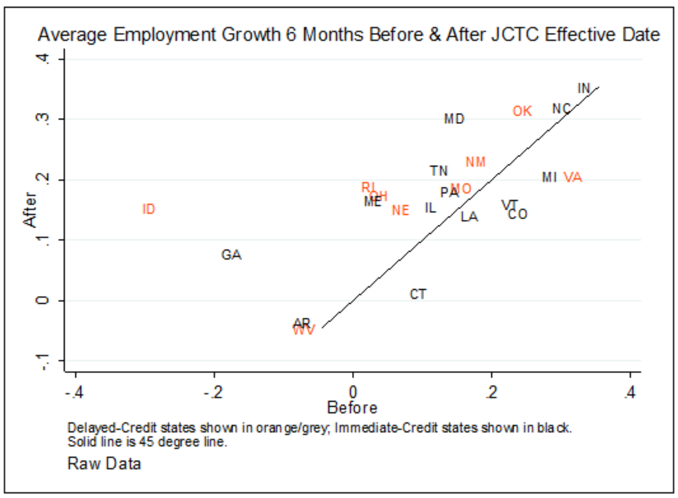


Chart 3: Average Employment Growth Before and After a JCTC Effective Date
Delayed vs. Immediate JCTCs
1, 6, or 12 Month Windows





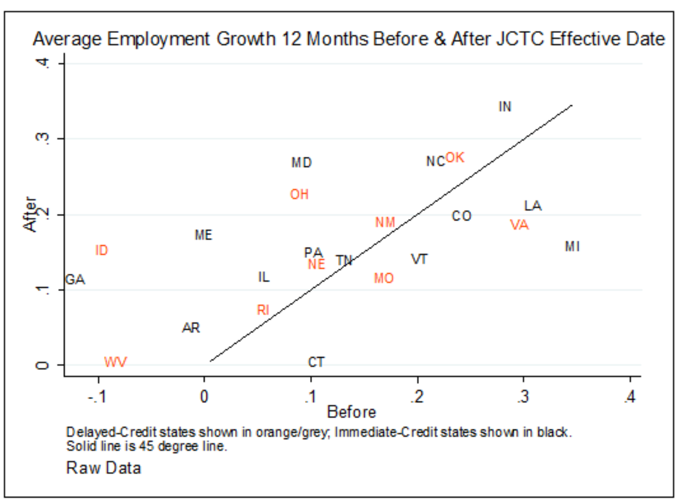
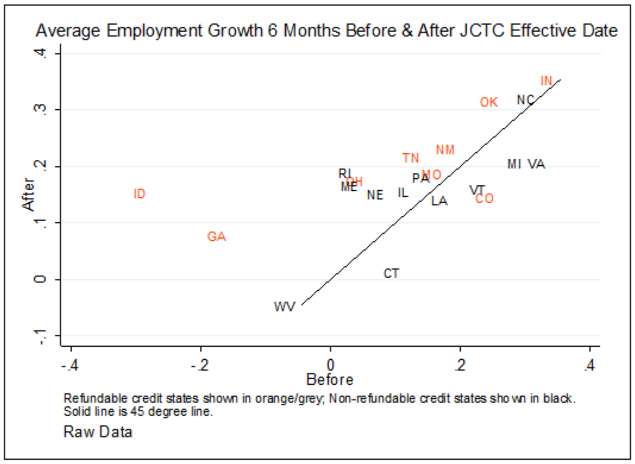
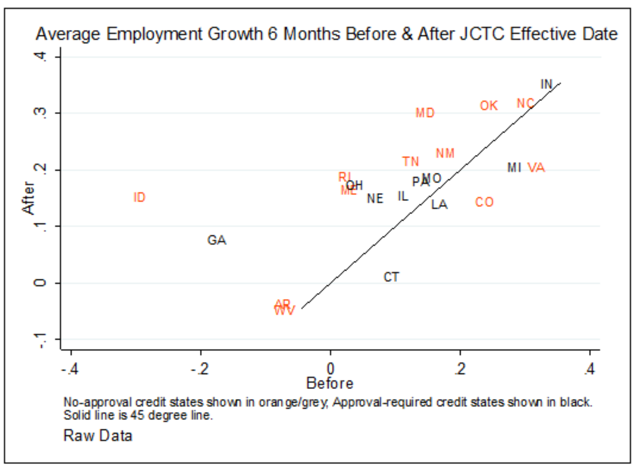


Chart 4: Average Employment Growth Before and After a JCTC Effective Date
Delayed vs. Immediate JCTCs
6 Month Window
Various Tax Credit Characteristics





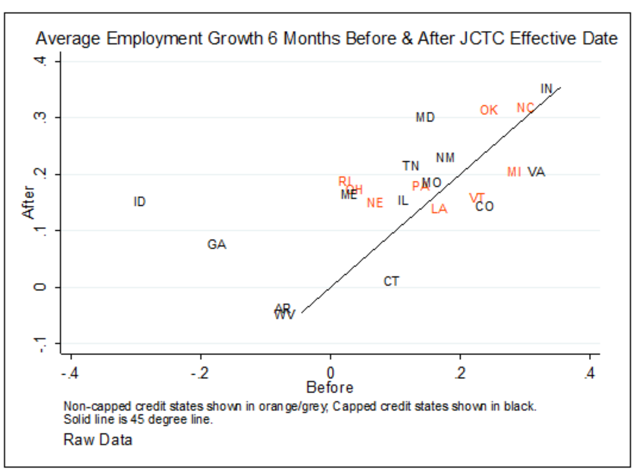


Chart 5: Theoretical Predictions of the Path of Employment around a JCTC "event"
No Rolling Base; No Inventory Costs

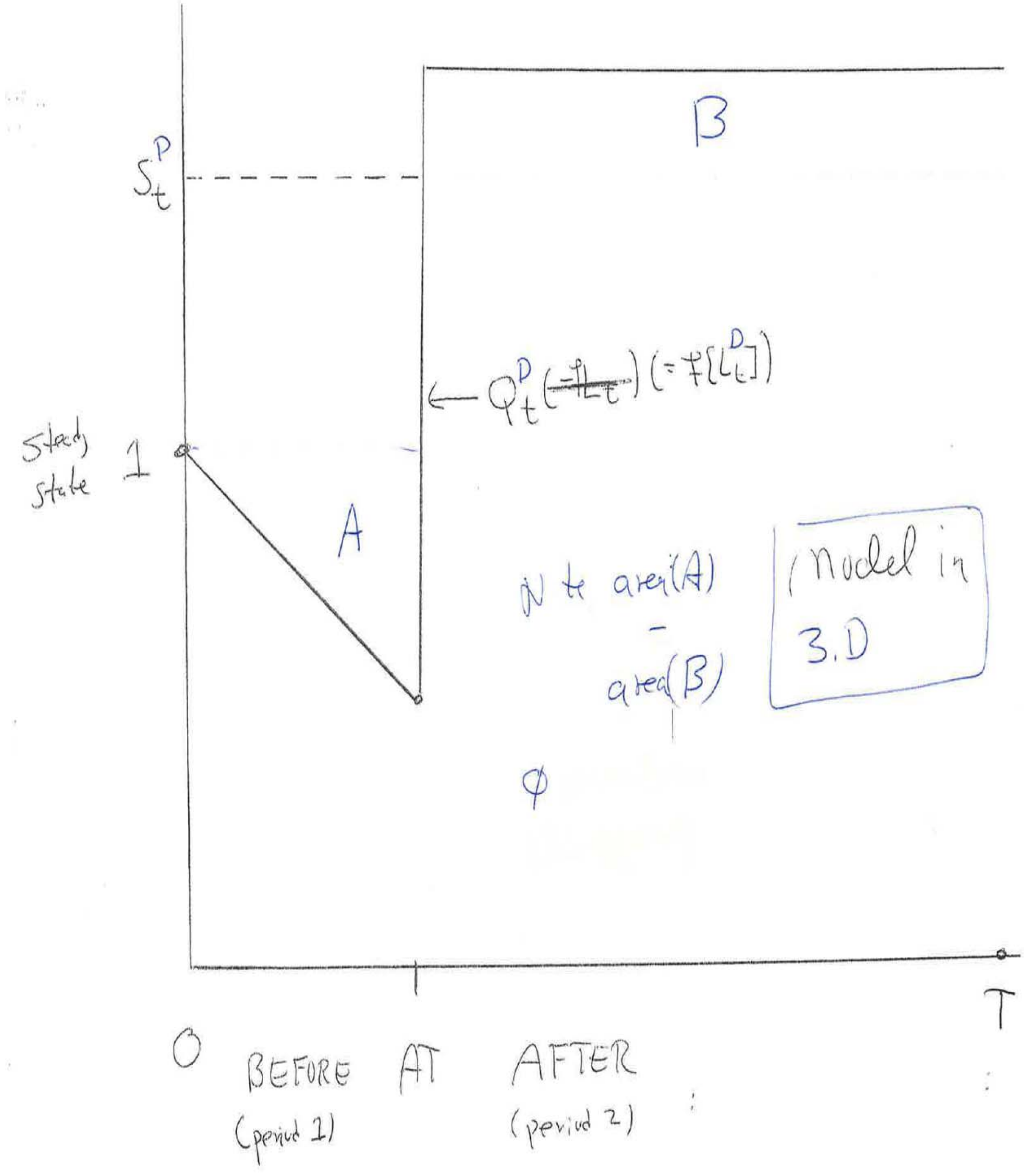


Chart 6: Theoretical Predictions of the Path of Employment around a JCTC "event" Without Inventory Costs

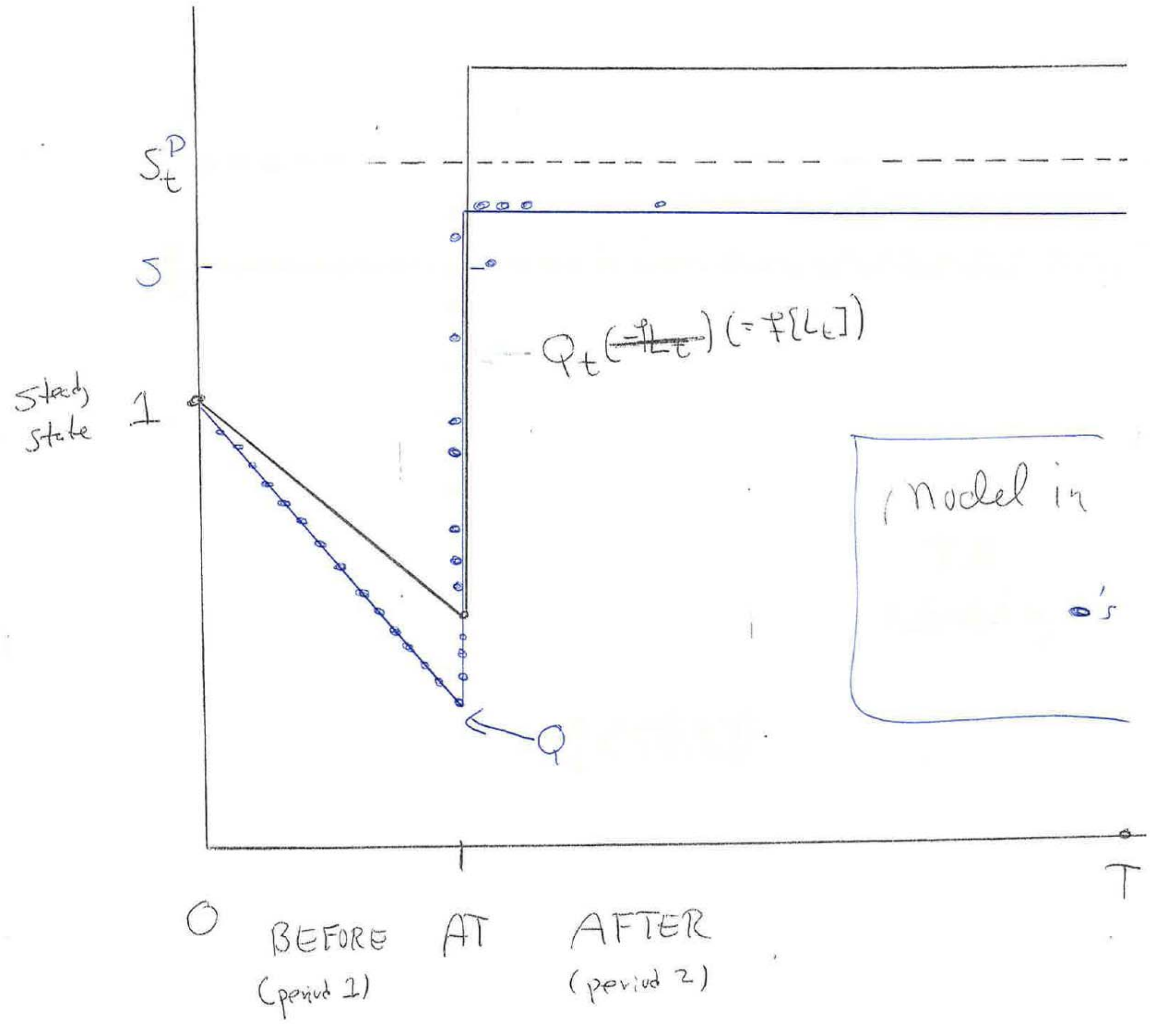
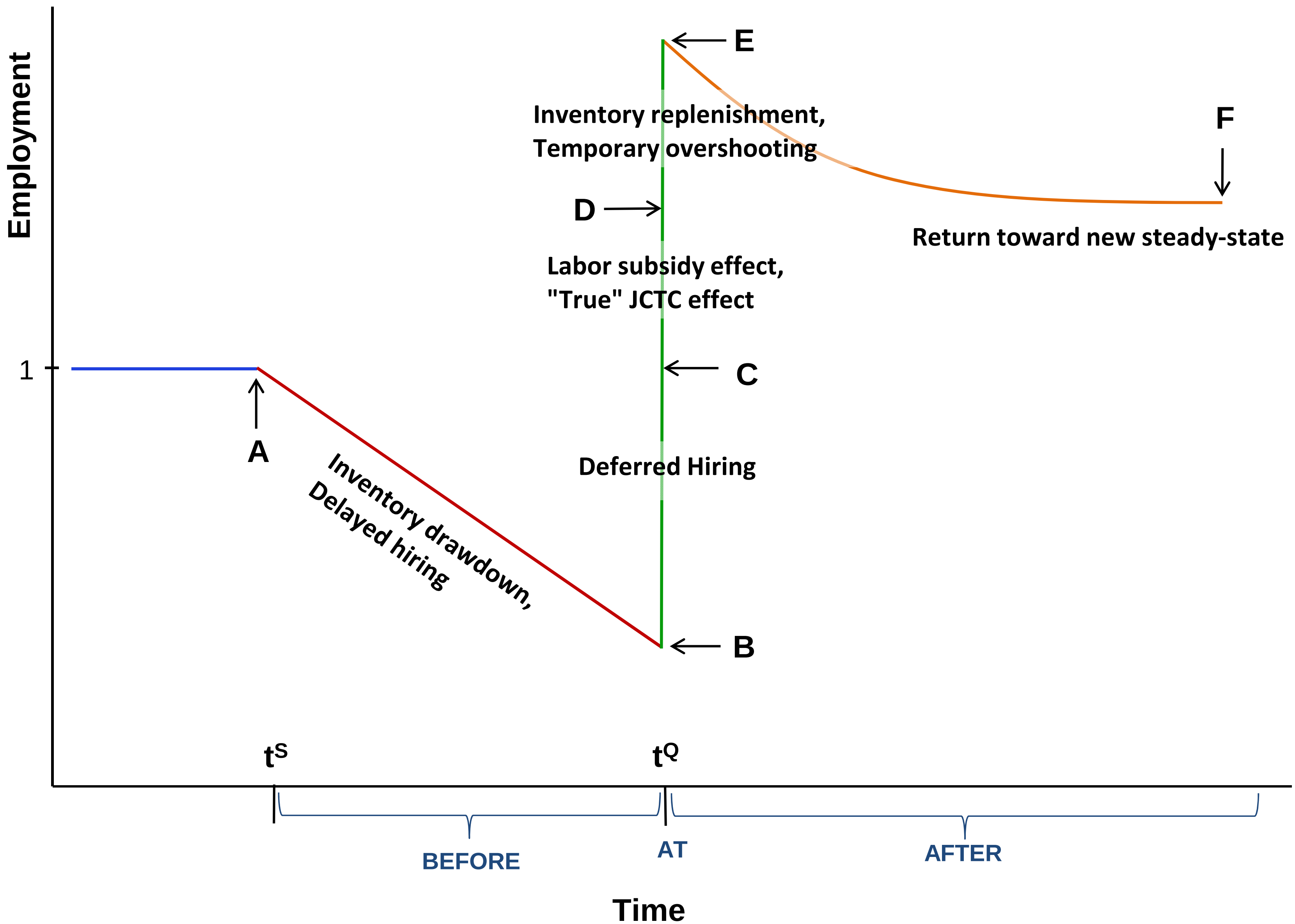


Chart 7: Theoretical Predictions of the Path of Employment around a JCTC "event" With Inventory Costs



Employment
1
A
Inventory drawdown,
Delayed hiring
B
Deferred Hiring
C
Labor subsidy effect,
"True" JCTC effect
D
Inventory replenishment,
Temporary overshooting
E
F
Return toward new steady-state
t^S
t^Q
BEFORE
AT
AFTER
Time

Table 1:

Post-JCTC and Pre-JCTC Employment Growth
T-tests of Equality

Panel A. N = 1 month			
	All JCTC states (1)	**Immediate States (2)**	**Delayed States (3)**
Mean Pre-JCTC Employment Growth	0.119	0.144	0.080
Mean Post-JCTC Employment Growth	0.244	0.164	0.367
Post-Pre Difference in Means	0.125	0.020	0.287
t-test for equality (p-value)	*[0.041]*	*[0.402]*	*[0.015]*
Difference-in-Difference*		0.267	
t-test for equality (p-value)		*[0.008]*	
Panel B. N = 6 months			
	All JCTC states (1)	**Immediate States (2)**	**Delayed States (3)**
Mean Pre-JCTC Employment Growth	0.114	0.140	0.074
Mean Post-JCTC Employment Growth	0.173	0.172	0.174
Post-Pre Difference in Means	0.059	0.033	0.100
t-test for equality (p-value)	*[0.048]*	*[0.241]*	*[0.036]*
Difference-in-Difference*		0.068	
t-test for equality (p-value)		*[0.129]*	
Panel C. N = 12 months			
	All JCTC states (1)	**Immediate States (2)**	**Delayed States (3)**
Mean Pre-JCTC Employment Growth	0.126	0.140	0.105
Mean Post-JCTC Employment Growth	0.162	0.169	0.152
Post-Pre Difference in Means	0.036	0.029	0.047
t-test for equality (p-value)	*[0.062]*	*[0.172]*	*[0.099]*
Difference-in-Difference*		0.018	
t-test for equality (p-value)		*[0.352]*	

* Defined as the [Post-Pre Difference for Delayed States] - [Post-Pre Difference for Immediate States].

Table 2: Expected Impacts Of JCTCs On Employment Growth By Regime, by Interval Theoretical Predictions

Regime	Before (1)	At (2)	After-Early (3)	After-Late (4)	Total (5)
Delayed	-	++	+ or -	0 or -	+
Immediate	N/A	+	+ or –	0 or –	+

Table 3: JCTC Adoption Decision
Equation (22)

	(1)	(2)	(3)	(4)
$\mathbf{LGROWTH^{12}_{i,t}}$	0.066 (0.083)			
$\mathbf{LGROWTH^{12}_{i,t} / LGROWTH^{12,Bordering}_{i,t}}$		-0.119 (0.114)		
$\mathbf{LGROWTH^{24}_{i,t}}$			0.002 (0.012)	
$\mathbf{LGROWTH^{24}_{i,t} / LGROWTH^{24,Bordering}_{i,t}}$				-0.014 (0.017)
$\mathbf{REPUBLICAN_{i,t}}$	-0.002 (0.006)	-0.003 (0.005)	-0.001 (0.001)	-0.001 (0.001)
COMPETITION $_{i,t}$	0.041 (0.021)	0.037 (0.018)	0.010 (0.004)	0.008 (0.003)
UCC $_{i,t}$	-0.636 (0.021)	-0.528 (0.021)	-0.145 (0.048)	-0.113 (0.039)
Fixed State Effects	Yes	Yes	Yes	Yes

Table notes follow the last table.

Table 4: Estimates Of The Employment Model In Log Levels Various Lag Lengths For The Lagged Dependent Variables

Panel A: Employment Specified In Log Levels Equations (23) And (25a)

J	$\tilde{\Psi}_J$	$\sigma_{\tilde{\Psi}_J}$	R^2	t-test, Jth Lag	r	σ_r
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	0.9734	0.0026	0.9799	368.3510	-0.0200	0.0104
2	0.9733	0.0026	0.9798	0.7466	-0.0001	0.0105
3	1.0236	0.0290	0.9796	-2.2351	-0.0026	0.0105
4	1.1120	0.0580	0.9796	-3.7660	-0.0031	0.0105
5	1.1790	0.0887	0.9794	-2.4392	-0.0011	0.0105
6	1.2290	0.1174	0.9792	-1.6640	-0.0014	0.0106
7	1.3095	0.1491	0.9792	-3.8106	-0.0058	0.0106
8	1.3269	0.1524	0.9791	-5.0839	-0.0027	0.0106
9	1.3285	0.1525	0.9791	-3.4147	-0.0027	0.0107
10	1.3256	0.1561	0.9790	-3.3215	-0.0050	0.0107
11	1.3408	0.1595	0.9790	-3.8486	-0.0019	0.0107
12	1.3442	0.1666	0.9787	-3.7749	-0.0031	0.0107

Panel B: Employment Specified In Growth Rates Equations (24) And (25b),

J	Ψ_J	σ_{Ψ_J}	R^2	t-test, Jth Lag	r	σ_r
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	-0.0301	0.0262	0.9219	-1.1464	0.0001	0.0104
2	-0.0080	0.0320	0.9224	1.4407	-0.0027	0.0105
3	0.0675	0.0479	0.9231	2.9601	-0.0032	0.0105
4	0.1661	0.0712	0.9234	1.6288	-0.0014	0.0105
5	0.2650	0.0981	0.9234	0.8529	-0.0010	0.0106
6	0.4059	0.1273	0.9240	2.9518	-0.0046	0.0106
7	0.5691	0.1563	0.9246	4.1367	-0.0019	0.0106
8	0.5619	0.1553	0.9251	2.2281	-0.0022	0.0106
9	0.5526	0.1552	0.9256	2.2609	-0.0046	0.0107
10	0.5801	0.1552	0.9260	2.4793	-0.0010	0.0107
11	0.6465	0.1565	0.9245	2.5308	-0.0015	0.0106
12	0.7110	0.1575	0.9241	4.7450	-0.0032	0.0108

Table notes follow the last table.

Table 5: Expected Impacts Of JCTCs On Employment Growth By Regime, By Interval
Cumulative Effect Over Each Interval
Equations (20 and 24)
JCTC Measured By Indicator Variable
With And Without An Adjustment For JCTC-Eligible Firms

	REGIME				
	With Eligibility Adjustment			Without Eligibility Adjustment	
INTERVAL	Delayed (1)	Immediate (2)		Delayed (3)	Immediate (4)
Before	-0.551	---------		-0.513	---------
	(0.214)	---------		(0.198)	---------
	[0.010]	---------		[0.010]	---------
At	0.180	0.068		0.167	0.064
	(0.105)	(0.037)		(0.098)	(0.035)
	[0.087]	[0.069]		[0.088]	[0.066]
After-Early	-0.133	0.048		-0.123	0.045
	(0.146)	(0.086)		(0.136)	(0.080)
	[0.362]	[0.579]		[0.365]	[0.572]
After-Late	-0.146	0.274		-0.139	0.256
	(0.272)	(0.175)		(0.253)	(0.164)
	[0.592]	[0.118]		[0.583]	[0.118]
Sum	-0.654	0.390		-0.612	0.366
	(0.371)	(0.180)		(0.345)	(0.168)
	[0.078]	[0.030]		[0.076]	[0.030]
CONTROL VARIABLES					
INDUSTRY MIX	-0.445			-0.445	
	(0.952)			(0.952)	
	[0.640]			[0.640]	
COMPETITION	-0.085			-0.085	
	(0.105)			(0.105)	
	[0.419]			[0.419]	

Table notes follow the last table.

Table 6: Expected Impacts Of JCTCs On Employment Growth By Regime, By Interval
Cumulative Effect Over Each Interval
Equations (20 and 24)
JCTC Measured By Indicator Variable
With And Without An Adjustment For JCTC-Eligible Firms
Sample Excludes States with Unknown Credit Rates

	REGIME				
	With Eligibility Adjustment			Without Eligibility Adjustment	
INTERVAL	Delayed (1)	Immediate (2)		Delayed (3)	Immediate (4)
Before	-0.610	---------		-0.566	---------
	(0.221)	---------		(0.205)	---------
	[0.006]	---------		[0.006]	---------
At	0.173	0.056		0.160	0.053
	(0.119)	(0.047)		(0.111)	(0.043)
	[0.147]	[0.233]		[0.147]	[0.226]
After-Early	-0.073	0.128		-0.067	0.121
	(0.153)	(0.100)		(0.143)	(0.093)
	[0.631]	[0.197]		[0.638]	[0.193]
After-Late	-0.331	0.361		-0.310	0.339
	(0.278)	(0.207)		(0.259)	(0.193)
	[0.234]	[0.080]		[0.231]	[0.080]
Sum	-0.847	0.546		-0.788	0.513
	(0.386)	(0.213)		(0.359)	(0.199)
	[0.028]	[0.010]		[0.028]	[0.010]
CONTROL VARIABLES					
INDUSTRY MIX	0.142			0.142	
	(1.000)			(1.000)	
	[0.998]			[0.998]	
COMPETITION	-0.081			-0.081	
	(0.107)			(0.107)	
	[0.451]			[0.451]	

Table notes follow the last table.

Table 7: Expected Impacts Of JCTCs On Employment Growth By Regime, By Interval
Cumulative Effect Over Each Interval
Equations (20 and 24)
JCTC Measured By Indicator Variable Times Credit Rate
With And Without An Adjustment For JCTC-Eligible Firms

	REGIME				
	With Eligibility Adjustment			**Without Eligibility Adjustment**	
INTERVAL	**Delayed (1)**	**Immediate (2)**		**Delayed (3)**	**Immediate (4)**
Before	-4.726	---------		-4.335	---------
	(4.144)	---------		(3.830)	---------
	[0.254]	---------		[0.258]	---------
At	3.252	0.259		3.019	0.240
	(1.250)	(0.064)		(1.145)	(0.059)
	[0.009]	[0.000]		[0.009]	[0.000]
After-Early	-0.728	0.682		-0.656	0.633
	(1.880)	(0.200)		(1.746)	(0.186)
	[0.699]	[0.001]		[0.707]	[0.001]
After-Late	-2.190	1.401		-2.006	1.317
	(4.655)	(0.645)		(4.322)	(0.603)
	[0.638]	[0.030]		[0.643]	[0.029]
Sum	-4.431	2.343		-4.013	2.191
	(6.279)	(0.596)		(5.813)	(0.556)
	[0.480]	[0.000]		[0.490]	[0.000]
CONTROL VARIABLES					
INDUSTRY MIX	-0.445			-0.445	
	(0.952)			(0.952)	
	[0.640]			[0.640]	
COMPETITION	-0.085			-0.085	
	(0.105)			(0.105)	
	[0.419]			[0.419]	

Table notes follow the last table.

Table 8: Baseline Results
Impacts Of JCTCs On Employment Growth By Regime, By Interval
Cumulative Effect Over Each Interval
Equations (20 and 24)
With And Without An Adjustment For JCTC-Eligible Firms

	With Eligibility Adjustment	
INTERVALS	**Delayed (1)**	**Immediate (2)**
Before	-0.551	---------
	(0.214)	---------
	[0.010]	---------
At	0.180	0.068
	(0.105)	(0.037)
	[0.087]	[0.069]
After-Early	-0.133	0.048
	(0.146)	(0.086)
	[0.362]	[0.579]
After-Late	-0.146	0.274
	(0.272)	(0.175)
	[0.592]	[0.118]
Sum	-0.654	0.390
	(0.371)	(0.180)
	[0.078]	[0.030]
CONTROL VARIABLES		
INDUSTRY MIX	-0.445	
	(0.952)	
	[0.640]	
COMPETITION	-0.085	
	(0.105)	
	[0.419]	

Table notes follow the last table.

Table 9: Impacts Of JCTCs On Employment Growth By Regime, By Interval, By Sector
Cumulative Effect Over Each Interval
Equations (20 and 24)
JCTC Measured By A Credit Rate Variable
Without An Adjustment For JCTC-Eligible Firms

	Retail Trade		**Leisure & Hospitality**		**Trade, Transp, Utilities**		**Education & Health**		**Professional Services**	
INTERVALS	**Delayed (1)**	**Immediate (2)**	**Delayed (3)**	**Immediate (4)**	**Delayed (5)**	**Immediate (6)**	**Delayed (7)**	**Immediate (8)**	**Delayed (9)**	**Immediate (10)**
Before	0.098	---------	0.267	---------	-0.543	---------	-0.574	---------	2.279	---------
	(0.669)	---------	(2.007)	---------	(0.759)	---------	(0.458)	---------	(1.418)	---------
	[0.884]	---------	[0.894]	---------	[0.475]	---------	[0.210]	---------	[0.108]	---------
At	1.784	0.043	1.333	-0.031	1.164	0.037	0.010	0.002	-0.313	0.090
	(0.674)	(0.020)	(0.565)	(0.030)	(0.519)	(0.025)	(0.080)	(0.009)	(0.127)	(0.033)
	[0.008]	[0.037]	[0.018]	[0.312]	[0.025]	[0.136]	[0.900]	[0.866]	[0.014]	[0.006]
After-Early	0.951	0.133	-0.005	0.299	0.264	0.133	-0.187	-0.183	0.438	0.167
	(1.164)	(0.069)	(0.785)	(0.098)	(0.969)	(0.046)	(0.445)	(0.060)	(0.586)	(0.080)
	[0.414]	[0.054]	[0.995]	[0.002]	[0.785]	[0.004]	[0.676]	[0.002]	[0.455]	[0.036]
After-Late	-3.059	0.323	0.067	0.282	-2.286	0.276	-0.031	-0.229	-0.581	0.648
	(1.895)	(0.208)	(0.925)	(0.183)	(1.479)	(0.121)	(1.622)	(0.153)	(2.859)	(0.303)
	[0.106]	[0.119]	[0.943]	[0.124]	[0.122]	[0.023]	[0.985]	[0.134]	[0.839]	[0.033]
Sum	-0.225	0.499	1.663	0.550	-1.405	0.446	-0.788	-0.411	1.842	0.904
	(2.132)	(0.195)	(2.390)	(0.209)	(1.738)	(0.118)	(1.555)	(0.152)	(2.991)	(0.278)
	[0.916]	[0.011]	[0.486]	[0.008]	[0.419]	[0.000]	[0.613]	[0.007]	[0.538]	[0.001]

Notes To Table 1: xx

Notes To Table 2: Theoretical predictions based on the analysis in Section 3. N/A: not applicable.

Notes to Table 3: Panel logit estimates of equation (22). The dependent variable, $D_{i,t}^{Signing}$, is an indicator variable taking the value of 1 in the JCTC signing month ($t^{Signing}$), 0 otherwise. The independent variables are employment growth over some number of prior months ($LGROWTH_{i,t}$) defined in four different ways (see Section 5.B for details), the fraction of bordering states with JCTCs over the prior 12 months ($COMPETITION_{i,t}$), an indicator variable reflecting the extent of Republican control of the state government ($REPUBLICAN_{i,t}$), and the user cost of capital measuring the nominal incentive effects due to business capital taxes ($UCC_{i,t}$). See Section 4.B and the Glossary for definitions of the other variables. Sample period is 1990.1 to 2009.9. Fixed state effects are included. The cells contain the point estimate, the standard error (computed by the Delta method) in parentheses, and the p-value in brackets for the null hypothesis that the coefficient equals zero.

Notes To Table 4: OLS estimates of equations (23, panel A) or (24, panel B) and (25). The dependent variable is $\ln\{L_{i,t}\}$ and $\Delta L_{i,t} / L_{i,t-1}$ in panels A and B, respectively. Sample period is 1990.1 to 2009.9. The C_i coefficients are unconstrained. Fixed state and time effects are included. Column 1: the lag length (J). Column 2: the summation of the lagged coefficients (Ψ_J, equation (25a)). Column 3: the standard error associated with Ψ_J. Column 4: the R^2. Column 5: the t-test for the null hypothesis that the coefficient on the J^{th} lag equals zero. Column 6: the first-order serial correlation coefficient (r, equation (25b)) for the residuals. Column 7: the heteroscedastic-consistent standard error associated with r.

Notes to Tables 5 to 9: OLS estimates of equations (31 and 35). The dependent variable ($\Delta L_t / L_{t-1}$) is employment growth. The control variables are "predicted" employment growth based on the industry mix ($\Delta L_{i,t}^P / L_{i,t-1}^P$) and the fraction of bordering states with JCTCs over the prior 12 months ($COMPETITION_{i,t}$). See Sections 4 and 5 and the Glossary for precise definitions. Sample period is 1990.1 to 2009.9. The γ coefficients vary by interval and by regime. The coefficients are multiplied by the average interval length, and represent the total effect over the interval. Fixed state and time effects and a local trend are included. The states constituting the two regimes are indicated in Chart 3. The cells contain the point estimate, heteroscedastic-consistent standard error in parentheses, and the p-value in brackets for the null hypothesis that the coefficient equals zero. N/A: not applicable.