Business Cycle Divergence and Risk Sharing: Blue States and Red States

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Abstract

We examine business cycle divergence and risk sharing within the United States as a whole and in U.S. 'regions' whose populations have consistently voted either Democrat (*Blue*) or Republican (*Red*) in national elections. We find that business cycle divergence across the states is larger than across international borders; and, it is starkest–and growing–across *Blue* and *Red* regions. The risk sharing mechanisms, including fiscal transfers and migration, also differ markedly across the political regions. However, allowing for additional sharing mechanisms unobserved in previous work, we find that overall risk sharing is high, even across the political divide.

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1 Introduction

As Europe moved deliberately, if uneasily, towards deepening monetary and economic union in the nineteen nineties, the U.S. economy provided a benchmark for envisaging Europe's future. The U.S. experience illustrated how idiosyncratic risks within a union could be smoothed despite having only a single, economy-wide monetary policy. Now, after European monetary and economic union has progressed, rising political tensions in Europe and elsewhere have reignited disagreements about the costs of monetary and economic union. Concerns over migration and fiscal transfers, along with regionally clashing political preferences–as evinced by Britain's 'Brexit' vote, the U.S. 2016 Presidential election, Germany's 2017 federal elections and the Italian 2018 election for example–raise questions about how business cycle risks are now shared. Do the political divisions themselves stand in the way of integration? Do they prevent risk sharing? Is the United States still an example of successful integration despite its own political divisions?

This paper focuses on the last question, but we believe our findings have implications for the first two as well. We examine the extent and mechanisms of risk sharing within the United States over the most recent decades. Our study benefits from newly available state-level U.S. consumption data, which we use to reevaluate and extend previous, related work. We also take advantage of sustained political differences across some of the states to examine whether business cycle divergence and the channels of risk sharing mirror the country's most obvious political divisions. Specifically, we build on the state-by-state analysis by constructing *Blue* and *Red* regions based on individual state voting patterns so that we can examine macroeconomic differences across the political 'colour regions'. We also consider additional smoothing channels not generally explored within the United States: in addition to the standard fiscal and financial flows, we allow for smoothing via interstate migration, through the purchases of durable goods, and through changes in prices.[1] To

[1] Here, allowing for smoothing via prices is equivalent to allowing for smoothing via real exchange rates: the real exchange rate is simply the relative price level adjusted for the nominal exchange rate, and the single currency precludes nominal exchange rate fluctuations; so, here (as in the Euro Area), a relative price change equals a real exchange rate change.

implement the price channel, we use state price indices constructed from underlying raw price data obtained from the Council for Community and Economic Research.[2]

We find that state business cycles diverge markedly, and the business cycles of the *Blue* and *Red* regions diverge even more: in terms of GDP, the *Blue* and *Red* regions look like two sovereign countries. At the same time, the findings suggest that output divergence within the United States provides an opportunity for smoothing consumption: consumption risk is indeed shared across states, and it is shared between the *Blue* and *Red* regions. We also find that the mixture of channels for risk-sharing differs substantially across the colour regions, and the additional risk-sharing channels that we explore are significant ones for the country as a whole: together, they cut unshared idiosyncratic risk in half. Overall, our findings indicate that–despite its own internal political and economic divisions, including differences in how risk sharing is achieved–the United States still provides a benchmark of economic integration. The stark political differences between the *Blue* and *Red* regions show up as regional economic differences, but their differences do not stand in the way of risk sharing. While we examine the United States, the implication is broadly applicable: asynchronous business cycles and even substantial political divisions are not by themselves impediments to a successful monetary union.[3]

Our work proceeds in three steps. We begin with a simple assessment of the extent of inter-state business cycle divergence within the United States in section 2, where we adapt the approach of Kalemli-Ozcan, Papaioannou, and Peydra (2013), who examine business cycle synchronicity across countries. Then, in section 3, we use the new consumption data to look at income and consumption together to examine the extent of consumption smoothing. There, we follow Rangvid, Santa-Clara, and Schmeling (2016) and others who examine the diversification of consumption risk internationally. Finally, in section 4, we rely on and extend the influential approach

[2]The Council for Community and Economic Research has published the *Cost of Living Index* quarterly since 1968. Various authors, including Parsley and Wei (1996), and Nakamura and Steinsson (2013) have studied the data underlying the Cost of Living Index.

[3]Alesina, Tabellini, and Trebbi (2017) provide a recent, detailed examination of the political differences within the United States and within Europe (or at least the EU 15 countries) and find them to be comparable.

of Asdrubali, Sorensen, and Yosha (1996) to examine *how* consumption risk is shared across the states.

2 Business Cycle Divergence

This section assesses the extent to which the business cycles of the states move together within the United States. We begin by looking at all of the states, then we look separately at regions that we define based on voting patterns.

As mentioned above, we adapt the international approach of Kalemli-Ozcan, Papaioannou, and Peydra (2013) to measure state business cycle synchronicity within the United States. Their measure uses the negative of the absolute difference in countries' GDP growth rates. While there are many possible approaches to characterizing business cycle synchronicity, their method is straightforward, and it is feasible even when the length of the time series is modest.[4] Adapting their international measure to states, we comparably define synchronicity among states as follows:

$$\psi_{i,j,t} = -|(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})|, \tag{2.1}$$

where $Y_{i,t}$ and $Y_{j,t}$ are the GDPs of the i^{th} and j^{th} states in year t. This measure becomes more negative when business cycles between two states are less synchronised.

Figure 1 shows in black the average in each year of this U.S. state-by-state measure of synchronicity from 1993 through 2015.[5] State-by-state business cycle synchronicity declined substantially in the mid-2000s until the great recession, when the state economies slowed together, then began briefly to recover together. Most recently, the state economies have again markedly diverged.

Over the period as a whole, the average divergence in bilateral GDP growth rates is about 2.5 percent. This number can be put into perspective by comparing it with

[4]While many studies in this literature, such as the early work of Frankel and Rose (1998), measure synchronicity using correlations, Kalemli-Ozcan, Papaioannou, and Peydra (2013) point out that the divergence measure used here is robust to various filtering methods, and it is unaffected by the volatility of output. The importance of the latter is emphasised by Doyle and Faust (2005). Kalemli-Ozcan, Papaioannou, and Peydra (2013), in turn, follow Giannone, Lenza, and Reichlin (2010).

[5]Data and their sources are described in the appendix.

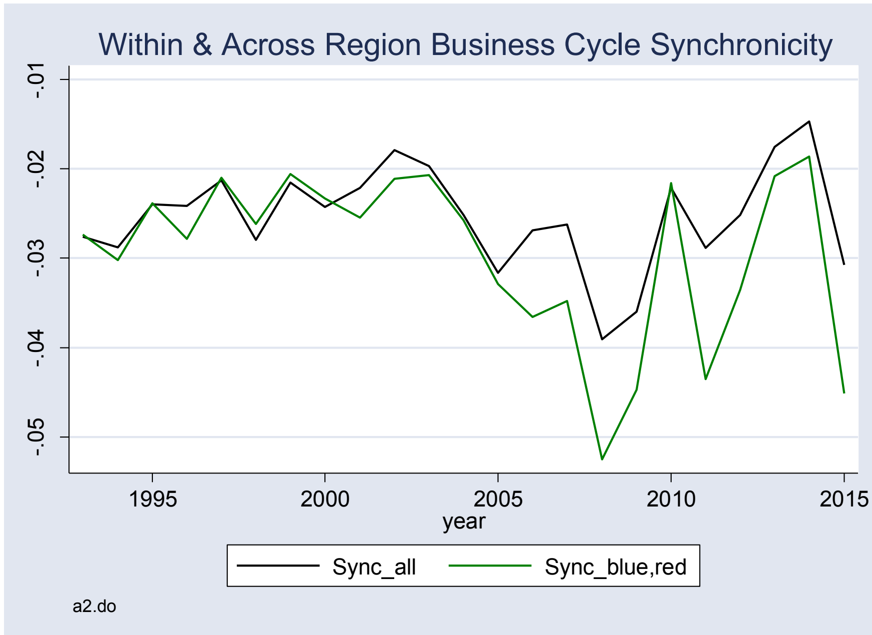

Figure 1: Business cycle synchronicity within the United States

synchronization measures for international economies. Kalemli-Ozcan, Papaioannou, and Peydra (2013) report an average divergence in bilateral real GDP growth rates of about 1.75 percent for 20 rich economies in the three decades before the 2008 downturn.[6] By this measure, the state economies within the United States are more asynchronous than comparable international economies.

We can correspondingly measure the synchronicity between the output in the region made up of the states whose residents consistently vote Democratic (*Blue*) in presidential elections and the output in the region made up of states whose residents consistently vote Republican (*Red*) in presidential elections.[7] Specifically, we designate a state as *Blue* if a majority of its voters chose a Democratic presidential

[6]Developing economies are less synchronised; see Calderón, Chong, and Stein (2007).

[7]While we focus on the macroeconomic differences between the *Blue* and *Red* states, numerous authors have explored household and individual level differences, including differences in family structure, education, and health. See, for example, Gelman, Park, Shor, and Cortina (2010) and Carbone and Cahn (2010).

candidate in every election between 1987 and 2015; and we designate it as *Red* if the majority of its voters chose a Republican presidential candidate in every election during the period. We designate all other states as 'swing' states.

The synchronicity measure is then:

$$Sync_{blue,red,t} = -|(\ln Y_{blue,t} - \ln Y_{blue,t-1}) - (\ln Y_{red,t} - \ln Y_{red,t-1})|, \tag{2.2}$$

where $Y_{blue,t}$ is t-period output in the 'region' made up of *Blue* states, and $Y_{red,t}$ is the t-period output in the 'region' made up of *Red* states. This measure is shown by the green line in figure 1. Until the mid-2000s, the economic activity in two groups of states were about as synchronised with each other as were the states within the country as a whole. However, the two diverged somewhat more markedly from each other in the run up to the crisis of 2008, and they only briefly returned to the degree of synchronicity exhibited by the country as a whole before diverging yet again.[8]

Other differences between the *Blue* states and the *Red* states become apparent when we examine the synchronicity within each of the two groups. Letting b equal the number of *Blue* states, and r equal the number of *Red* states, the average synchronicity within each colour region is given by:

$$Sync_{blue,t} = -\frac{2}{b(b-1)}|(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})|, \forall i,j \in Blue \tag{2.3}$$

$$Sync_{red,t} = -\frac{2}{r(r-1)}|(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})|, \ \forall i,j \in Red. \tag{2.3'}$$

These measures are shown in Figure 2: the blue line gives the synchronicity among *Blue* states, and the red line gives the synchronicity among the *Red* states. The economies of the *Blue* states move together more than do the economies of the *Red* states. The difference between the two colour regions is most evident recently: economic activity among *Blue* states has converged, while it has diverged among

[8] A Chow test for a structural break half-way through the sample (significant at the one-percent level) helps to confirm the visual impression that economic growth in the *Blue* and *Red* states is more divergent now than in the past.

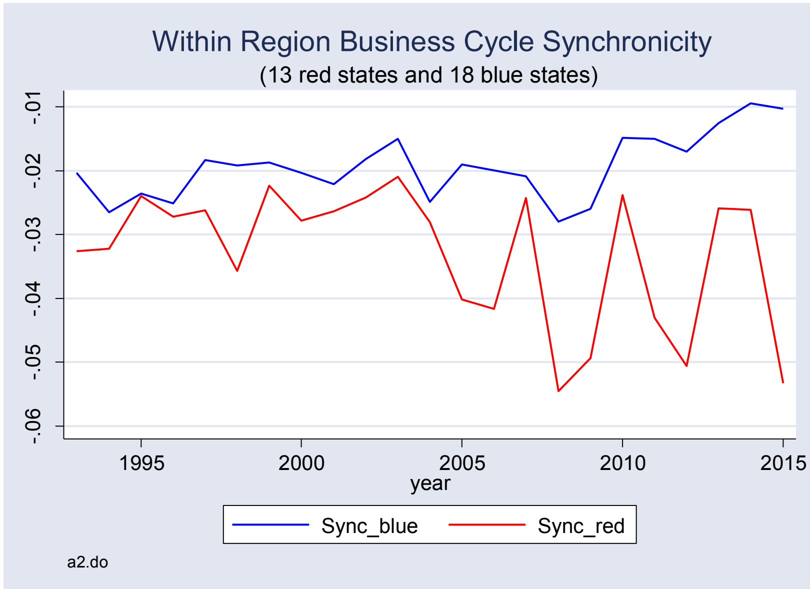

Figure 2: Business cycle synchronicity among Red states and among blue states

Red states. Over the period as a whole, the average divergence in bilateral GDP growth rates among the consistently *Blue* states is about 1.9 percent; and the average divergence among the consistently *Red* states, at about 3.3 percent, is much more pronounced.[9]

Overall, the synchronicity measures given in this section indicate that–in terms of economic activity–the state economies of the United States diverge greatly. For the country as a whole, the economies of the individual states are as varied as if they were distinct countries. This is particularly true of the *Red* states. Moreover, for *Red* states, the divergence has been greatest over the last decade. Whether within the colour regions, across the colour regions, or for the country as a whole, economic activity across the states varies greatly.

In the next section, we explore whether the pronounced divergence in economic activity is carried over to consumption, or if instead consumption risk is shared across

[9]The difference, 1.4 percent with a standard error is 0.2 percent, is statistically significant at all standard confidence levels.

the states.

3 Consumption Smoothing

The divergence of economic activity across states, regions, and countries in principle can provide an opportunity for integrated areas to share risk in order to smooth their consumption.[10] That is, consumers in integrated economies can benefit from output divergence. In the simplest case of two economies with exogenously given production, individuals in each of the two economies can share risk by holding assets that pay out in the other economy's production. Their consumption would then be related even when their production is not.[11] With consumption risk spread between the two economies, neither economy's consumption would be tied lock step to its own production, and divergent economic activity would allow both economies to smooth consumption. Moreover, in the spirit of Helpman and Razin (1978), Obstfeld (1994) shows that integration itself can induce specialization, which in turn would lead to output divergence.[12]

In this section, we look at consumption and income together to asses the extent of state-level consumption smoothing within the United States. Using consumption data not available at the time of the previous studies of U.S. consumption smoothing, we find that a great deal of consumption risk indeed is shared within the United States. This contrasts with the international evidence. That is, while economic activity is as asynchronous across the states as it is internationally, consumption smoothing tells a different story: consumption risk is shared within the United States, even across the *Blue* and *Red* regions, much more than it is internationally. (*How* that sharing is accomplished is the subject of section 4.)

This section's examination of consumption and income follows Rangvid, Santa-Clara, and Schmeling (2016), Kose, Prasad, and Terrones (2009), Lewis (1996), Ob-

[10] There is a large literature exploring the many facets of the theoretical relationship between economic integration and business cycle synchronicity. Both Doyle and Faust (2005) and Imbs (2004) provide overviews of the theoretical ambiguities in the context of related empirical work.

[11] For example, with iso-elastic utility and complete asset markets, the consumption growth rates in the two economies would be completely equalised.

[12] Kalemli-Ozcan, Sorensen, and Yosha (2003) and Imbs (2004) document that specialization and risk sharing are linked both regionally and internationally.

stfeld (1993), and others who examine the diversification of consumption risk internationally. Specifically, we regress idiosyncratic consumption growth on idiosyncratic income growth. Where consumption risk is shared, the estimated coefficient on idiosyncratic income should be low.

To measure consumption for each state, we use the Bureau of Economic Analysis' data on personal consumption expenditures, which is now the Bureau's most comprehensive measure of household consumption. The Bureau of Economic Analysis released its first prototype of these data in 2014, but the series begins in 1997; this makes it possible to include a substantial period both before and after the global crisis. Earlier key studies relied on retail sales data to gauge consumption.[13] While the retail sales data go further back in time, the new personal consumption expenditures data provide a more comprehensive measure of the purchases by residents of each state (including such things as travel expenditures, housing and financial services, and the net expenditures of nonprofit institutions serving households), and it does not conflate those purchases with purchases made by nonresidents. These new data also allow us to separately examine the use of durable goods purchases as a mechanism for smoothing consumption. For comparability with earlier work, we focus on total personal consumption in this section; however, in the next section, where we study the the channels of smoothing, we separate out durable goods purchases, which themselves can be thought of as a saving vehicle that can be used to smooth consumption.

We begin by examining consumption risk sharing within the United States as a whole. Let $c_{i,t}$ equal the growth rate of consumption in the i^{th} state in year t. We regress each state's idiosyncratic rate of consumption growth on its idiosyncratic rate of GDP growth in a panel, as follows:

$$c_{i,t} - \overline{c}_t = \beta_{u.s.}(y_{i,t} - \overline{y}_t) + v_{i,t}. \tag{3.1}$$

[13]Asdrubali, Sorensen, and Yosha (1996) pioneered the use in this context of state retail sales data, which they scaled up by the ratio of aggregate personal consumption to U.S. retail sales. Their use of retail sales was followed by Athanasoulis and van Wincoop (2001), Asdrubali and Kim (2004), and many others.

In each period, the average consumption, $\overline{c}_t$, and the average output growth, $\overline{y}_t$, is each defined over all of the United States. An output coefficient equal to zero would imply that states completely insulate their consumption from idiosyncratic changes in income. In contrast, a coefficient equal to one would imply that the states are individually in autarky.

Table 1: Consumption Smoothing

$c_{i,t} - \overline{c}_t$	(1)	(2)
$y_{i,t} - \overline{y}_t$	0.2234 (-0.0119)	
$d_{blue,i}(y_{i,t} - \overline{y}_t)$		0.2131 (0.060)
$d_{red,i}(y_{i,t} - \overline{y}_t)$		0.2307 (0.048)
$d_{swing,i}(y_{i,t} - \overline{y}_t)$		0.2413 (0.074)
Observations	900	900
R^2	0.299	0.301

Notes: This table provides estimates of Equations 3.1 and 3.2 using annual data from 1997 through 2015; robust standard errors are clustered at the state level and reported in parentheses.

The first column of table 1 gives the results of this regression. As shown, the estimated coefficient on idiosyncratic output growth is 0.22. That is, just over one-fifth of a state's idiosyncratic output growth shows up in a corresponding change in its consumption. This implies a much higher degree of risk sharing than is reported in international studies. For example, with more than a century of data for risk sharing among rich countries, Rangvid, Santa-Clara, and Schmeling (2016) report values of consumption risk sharing that imply coefficient estimates ranging from about 0.40

to about 0.85.[14] The much lower coefficient estimate we find for the United States is well below even the nadir of their international values. For the country as a whole, consumption risk sharing among the states is much greater than is international consumption risk sharing.

We also examine whether consumption risk sharing differs among the states whose residents vote consistently red, among states whose residents vote consistently blue, and among the remaining states. Specifically, we estimate the following regression using the same panel data:

$$c_{i,t} - \overline{c}_t = \sum_{\substack{j=blue,\\ red,\\ swing}} \beta_j d_{j,i}(y_{i,t} - \overline{y}_t) + u_{i,t}, \tag{3.2}$$

where $d_{j,i}$ are indicator variables for states whose residents have voted consistently blue ($j = blue$) or consistently red ($j = red$) in presidential elections, or whose residents have not voted consistently ($j = swing$).

The results of this estimation are shown in the second column of table 1. While the point estimates themselves might indicate that consumption in the *Blue* states is slightly less tied to idiosyncratic state GDP growth than is the consumption in *Red* states or in swing states, the differences are not statistically significant at any conventional significance level. The estimates for each of the three state groupings are all roughly on par with the estimate for the country as a whole. All of the coefficient estimates indicate that there is much more consumption risk sharing among the states than across international borders.

The estimates provided in this section show that consumption risk sharing within the United States is substantial. The wide divergence in economic activity across states enables residents to share risk and correspondingly smooth their consump-

[14] Rangvid, Santa-Clara, and Schmeling (2016) construct 'consumption risk sharing values' by multiplying their regression estimates by 100, then subtracting the product from 100. They report consumption risk sharing values of 15 to 60, which imply the coefficient estimates of about 0.40 to 0.85 mentioned above. In terms of their measures, our estimate of about 0.22 implies a consumption risk sharing value of 78, which exceeds even the peak of their reported international risk sharing. Risk sharing among emerging and low-income economies tends to be even lower.

tion regardless of political differences. In the next section, we explore how that is accomplished.

4 Risk Sharing Channels

This section examines the key channels for sharing consumption risk. While the previous section documented that consumption risk is shared within the United States, this section examines *how* it is shared. Here, we estimate the extent to which idiosyncratic consumption is smoothed via financial markets and via fiscal transfers, and we expand the usual list of U.S. channels to include changes in population, durable goods consumption, and states' prices (real exchange rates).[15]

As before, we first estimate the channels for the country as a whole, then we look separately at *Blue* and *Red* states. Allowing for the additional channels, we are able to observe more risk sharing than has previously been reported for the United States as a whole, and we find important differences between the *Blue* and *Red* states.

We begin with the now-standard identity of Asdrubali, Sorensen, and Yosha (1996):

$$Y_{i,t} = \frac{Y_{i,t}}{\tilde{Y}_{i,t}} \frac{\tilde{Y}_{i,t}}{Y_{i,t}^d} \frac{Y_{i,t}^d}{C_{i,t}} C_{i,t}. \tag{4.1}$$

As above, $Y_{i,t}$ is defined as the i^{th} state's GDP. $\tilde{Y}_{i,t}$ is defined as the i^{th} state's income, which includes net payments of dividend, interest and rent across state borders. $Y_{i,t}^d$ is defined as the i^{th} state's disposable income, which accounts for taxes and transfers (including social security), and Federal grants to states; and $C_{i,t}$ is the i^{th} state's consumption.

As pointed out by Asdrubali, Sorensen, and Yosha (1996), risk sharing via the capital market diminishes the correlation between $\tilde{Y}_{i,t}$ and $Y_{i,t}$. Likewise, risk sharing via Federal transfers diminishes the correlation between $Y_{i,t}^d$ and $Y_{i,t}$. Risk that

[15] These channels have been explored in other, related settings: for example, Asdrubali, Tedeschi, and Ventura (2015) and Jappelli and Pistaferri (2011) use detailed Italian survey data, which now include data on the consumption of durables, to carefully quantify household consumption smoothing in Italy; and Labhard and Sawicki (2006) examine prices as a smoothing mechanism within the United Kingdom using a slightly different approach.

remains unshared shows up in the correlation that remains between $C_{i,t}$ and $Y_{i,t}$. Thus, their identity provides a way of assessing the empirical importance of these consumption smoothing channels.

To the smoothing channels they originally explored, we add three more.[16] First, we allow for smoothing through the purchases of consumer durables, which can be thought of as a nonfinancial form of saving. Our inclusion of consumer durables follows Asdrubali, Tedeschi, and Ventura (2015), who use Italian household survey data around the time of the global crisis. Second, we add a migration channel. Finally, we add a price channel, which, for the United States, is the same as a real exchange rate channel since the "nominal exchange rate" is fixed across all states.[17] These additions yield a new identity:

$$Y_{i,t} = P_{i,t} L_{i,t} \frac{Y_{r,i,t}}{\tilde{Y}_{r,i,t}} \frac{\tilde{Y}_{r,i,t}}{Y^d_{r,i,t}} \frac{Y^d_{r,i,t}}{C_{r,i,t}} \frac{C_{r,i,t}}{C_{N,r,i,t}} C_{N,r,i,t}. \tag{4.2}$$

Here, $P_{i,t}$ is the i^{th} state's price level, and $L_{i,t}$ is its population; the subscripts r indicate real per capita values; $C_{D,r,i,t}$ represents real per capita durable goods consumption; and $C_{N,r,i,t}$ represents real per capita consumption of nondurable goods and services, which is the difference between real total consumption and real durable goods consumption: $C_{N,r,i,t} = C_{r,i,t} - C_{D,r,i,t}$.[18] Taking logs and first differences, this

[16] Work by Chinn and Wei (2013) and others suggests that one might also wish to examine smoothing via what would be state 'current accounts.' We do not add the current account as a channel here for two reasons: first, only limited state-level data are available; and, second, in the absence of state-level official reserve transactions, state-level currents accounts are in principle mirrored in the capital transactions captured by the original channels of Asdrubali, Sorensen, and Yosha (1996), described above.

[17] The real exchange rate equals the product of the nominal exchange rate and the ratio of the price levels. So, the change in the real exchange rate, given a constant nominal exchange rate, equals the change in the ratio of the price levels. In the implementation below, equation (4.5) implicitly defines the price change for each state relative to the country as a whole, since the aggregate price change is captured by $\nu_{P,t}$. Thus, the relative price changes discussed below are equivalent to real exchange rate changes.

[18] The change in a state's population equals migration plus births less deaths. Below, we estimate the extent to which idiosyncratic population changes account for consumption smoothing at the annual level. We discuss the smoothing as occurring through migration; however, it is in principle possible that the smoothing we measure also occurs in some small part through reactions in births and deaths.

becomes:

$$y_{i,t} = p_{i,t}+l_{i,t}+(y_{r,i,t}-\tilde{y}_{r,i,t})+(\tilde{y}_{r,i,t}-y^d_{r,i,t})+(y^d_{r,i,t}-c_{r,i,t})+(c_{r,i,t}-c_{N,r,i,t})+c_{N,r,i,t}, \quad (4.3)$$

where $p_{i,t}$ and $l_{i,t}$ are the log changes in state prices and population, and $y_{r,i,t}$, $\tilde{y}_{r,i,t}$, $y^d_{r,i,t}$, $c_{r,i,t}$, $c_{N,r,i,t}$ are the log changes in state per capita GDP, income, disposable income, consumption, and nondurable consumption.

To gauge the relative role of each potential smoothing channel under consideration, one can multiply equation (4.3) by $y_{i,t}$ and take the expected value; when scaled by the variance of $y_{i,t}$, this gives a simple sum:

$$1 = \beta_P + \beta_L + \beta_K + \beta_F + \beta_S + \beta_{C_D} + \beta_U, \quad (4.4)$$

where each term is equivalent to a single coefficient in a univariate regression.[19] Imposing the adding up constraint of equation 4.4 implies a SUR panel regression:

$$\begin{aligned}
p_{i,t} &= \nu_{P,t} + \beta_P y_{i,t} + \eta_{P,i,t} \\
l_{i,t} &= \nu_{L,t} + \beta_L y_{i,t} + \eta_{L,i,t} \\
y_{r,i,t} - \tilde{y}_{r,i,t} &= \nu_{K,t} + \beta_K y_{i,t} + \eta_{K,i,t} \\
\tilde{y}_{r,i,t} - y^d_{r,i,t} &= \nu_{F,t} + \beta_F y_{i,t} + \eta_{F,i,t} \\
y^d_{r,i,t} - c_{r,i,t} &= \nu_{S,t} + \beta_S y_{i,t} + \eta_{S,i,t} \\
c_{r,i,t} - c_{N,c,i,t} &= \nu_{D,t} + \beta_D y_{i,t} + \eta_{D,i,t} \\
c_{N,c,i,t} &= \nu_{U,t} + \beta_U y_{i,t} + \eta_{U,i,t}.
\end{aligned} \quad (4.5)$$

Here $\nu_{\cdot,t}$ are time fixed effects that capture factors that are common across states in each period, making the estimates analogous to the idiosyncratic measures used in sections 2 and 4. We write this more compactly as:

[19]Specifically, $\beta_P = \frac{cov(p_{i,t},y_{i,t})}{var(y_{i,t})}$, $\beta_L = \frac{cov(l_{i,t},y_{i,t})}{var(y_{i,t})}$, $\beta_K = \frac{cov(y_{r,i,t}-\tilde{y}_{r,i,t},y_{i,t})}{var(y_{i,t})}$, $\beta_F = \frac{cov(\tilde{y}_{r,i,t}-y^d_{r,i,t},y_{i,t})}{var(y_{i,t})}$, $\beta_S = \frac{cov(y^d_{r,i,t}-c_{r,i,t},y_{i,t})}{var(y_{i,t})}$, $\beta_{C_D} = \frac{cov(c_{r,i,t}-c_{N,c,i,t},y_{i,t})}{var(y_{i,t})}$, $\beta_{C_N} = \frac{cov(c_{N,c,i,t},y_{i,t})}{var(y_{i,t})}$.

$$\mathbf{y}_{i,t} = \boldsymbol{\nu}_t + \boldsymbol{\beta} y_{i,t} + \boldsymbol{\eta}_{i,t}, \tag{4.6}$$

where $\mathbf{y}_{i,t} = [p_{i,t}, l_{i,t}, (y_{r,i,t} - \tilde{y}_{r,i,t}), (\tilde{y}_{r,i,t} - y^d_{r,i,t}), (y^d_{r,i,t} - c_{r,i,t}), (c_{r,i,t} - c_{N,r,i,t}), (c_{N,r,i,t})]'$; $\boldsymbol{\nu}_t = (\nu_{P,t}, \nu_{L,t}, \nu_{K,t}, \nu_{F,t}, \nu_{S,t}, \nu_{C_D,t}, \nu_{U,t})'$; $\boldsymbol{\beta} = (\beta_P, \beta_L, \beta_K, \beta_F, \beta_S, \beta_{C_D}, \beta_U)'$, and $\boldsymbol{\eta} = (\eta_{P,i,t}, \eta_{L,i,t}, \eta_{K,i,t}, \eta_{F,i,t}, \eta_{S,i,t}, \eta_{C_D,i,t}, \eta_{C_N,i,t})'$.

The panel estimates of equation 4.6 measure the role of each smoothing channel and are given in table 2.

4.1 All States

The first column of table 2 gives the channel estimates for a panel that includes all states. Consistent with earlier studies, the largest share of smoothing occurs in the capital market, given in the first pair of rows. Capital markets now smooth about 43 percent of states' idiosyncratic risk. Despite the many changes in capital markets in the United States in the last three decades, this estimate is roughly on par with that of Asdrubali, Sorensen, and Yosha (1996), who find that about 39 percent of states' idiosyncratic risk is shared in U.S. capital markets.[20]

The next pair of rows gives the estimate for the extent of smoothing that occurs through taxes and transfers. About 16 percent of idiosyncratic output is smoothed through such fiscal flows.[21] Again–despite the many changes in the intervening period–this estimate is close to that of Asdrubali, Sorensen, and Yosha (1996), who find that about 13 percent of states' idiosyncratic risk is shared this way.[22] It is also not far from the range of estimates provided in von Hagen (1998), who gives a summary of earlier studies, though it is somewhat lower than the more recent estimate of roughly 25 percent reported in Feyrer and Sacerdote (2013). Notably, the role of U.S. fiscal flows is much higher than the four to six percent reported in

[20] Hepp and von Hagen (2013) find a slightly higher fraction, about 50 percent, for Germany since the nineties, but Buti (2007) reports lower numbers for most of the Euro Area.

[21] Since we are interested in the ability of states to share risks across state lines, we follow the literature and report how much fiscal flows offset states' idiosyncratic risks. Fiscal flows typically offset somewhat more of the nation-wide, overall fluctuations in GDP.

[22] In terms of statistical significance, we cannot reject at any reasonable confidence level the hypothesis that the fiscal flow channel amounts to the 13 percent given in Asdrubali, Sorensen, and Yosha (1996).

Table 2: Channels of Consumption Smoothing

	U.S. (1)	Blue (2)	Red (3)	Swing (4)
Capital: $\beta_K, \delta_j \beta_K$	0.4288	0.4489	0.3764	0.4980
	(0.0236)	(0.0517)	(0.0424)	(0.0460)
Fiscal: $\beta_F, \delta_j \beta_F$	0.1579	0.1703	0.2627	0.0604
	(0.0320)	(0.0710)	(0.0600)	(0.0548)
Saving: $\beta_S, \delta_j \beta_S$	0.1699	0.1333	0.1329	0.1569
	(0.0179)	(0.0400)	(0.0329)	(0.0330)
Durables: $\beta_{C_D}, \delta_j \beta_{C_D}$	0.0207	0.0392	0.0115	0.0339
	(0.0032)	(0.0073)	(0.0047)	(0.0062)
Prices: $\beta_P, \delta_j \beta_P$	0.0283	0.0583	0.0250	0.0178
	(0.0118)	(0.0401)	(0.0131)	(0.0164)
Migration: $\beta_L, \delta_j \beta_L$	0.0783	0.0921	0.0393	0.1532
	(0.0094)	(0.0144)	(0.0132)	(0.0229)
Unshared: $\beta_U, \delta_j \beta_U$	0.1161	0.0579	0.1521	0.0799
	(0.0076)	(0.0459)	(0.0190)	(0.0267)
Observations	900	234	324	342

Notes: This table provides estimates of Equations 4.6 and 4.7 using annual data from 1997 through 2015; robust standard errors are clustered at the state level and reported in parentheses.

Buti (2007) for European countries by the European Commission just prior to the Financial Crisis.[23]

The role of credit or saving, as conventionally measured, is given in the next pair of rows. For the country as a whole, credit smooths an estimated 17 percent of states' idiosyncratic risk. While this is somewhat lower than the 23 percent originally reported by Asdrubali, Sorensen, and Yosha (1996), it somewhat higher than the more recent U.S. estimate of 12 percent reported in Milano and Reichlin (2017) and Milano (2017). It is also remarkably close to European estimates of about 15 percent, reported by the European Commission in Buti (2007).

The next three pairs of rows provide estimates for the added channels: durable goods, prices, and migration. Another benefit of the newly available state-by-state consumption data is that we are able to estimate the extent to which durable goods purchases are used as a saving device to further smooth consumption. For the United States as a whole, durable goods smooth about two percent of states' idiosyncratic risk. While this is small compared with estimates for the traditional credit channel, it is very tightly estimated, and combined with the conventional credit measure it brings the estimate of the role of savings up to 19 percent.[24]

The role of changes in states' prices is given in the next pair of rows. While the states share a single currency, their prices nevertheless adjust enough relative to one another to have some risk sharing impact: changes in relative prices smooth about three percent (statistically significant at the five percent level) of states' idiosyncratic risk. This estimate is in keeping with that found across regions within the United Kingdom by Labhard and Sawicki (2006), who use a slightly different, though related, approach.

Substantially more consumption smoothing occurs through migration. As shown in the next pair of rows, migration smooths almost eight percent of states' idiosyncratic income growth. One might have expected an even larger value since the United States is often regarded as having a highly mobile labour force that is very responsive

[23]It is also higher than the roughly ten percent reported for inter-provincial fiscal smoothing within China; see Du, He, and Rui (2011).

[24]It is also larger than the extent of smoothing via durables that appears to be suggested by Asdrubali, Tedeschi, and Ventura (2015) for Italian households.

to labour conditions; and intra-U.S. migration remains high relative to intra-Europe migration.[25] However, Dao, Furceri, and Loungani (2017) show that the U.S. migration response to relative economic conditions–while still high by international standards–has roughly halved since the 1990s, the start of the sample period in our study.

Together, the three additional channels–durable goods purchases, changes in relative prices, and migration–reduce the unshared idiosyncratic risk by more than half. They account for roughly 13 percent more consumption smoothing, which leaves states with only about 12 percent of their idiosyncratic risk unshared. In their original study examining consumption smoothing from 1964-1990, Asdrubali, Sorensen, and Yosha (1996) reported that a quarter of the idiosyncratic changes in income remained unshared. A generation later, if we were to ignore our added channels, we would find that the fraction is still the same.

4.2 colour Regions

Next, we examine the channels within each colour region. That is, we reestimate equation 4.6 for states whose residents vote consistently red, for states whose residents vote consistently blue, and for the remaining states. Adapting equation 4.6 using the same indicators of colour region used in section 3, $d_{j,i}$, where $j = red$, $blue$, and $swing$, we have:

$$\mathbf{y}_{i,t} = \sum_{\substack{j=blue,\\ red,\\ swing}} \boldsymbol{\nu}_{j,t} + \sum_{\substack{j=blue,\\ red,\\ swing}} \boldsymbol{\beta}_j d_{j,i} y_{i,t} + \boldsymbol{\eta}_{i,t}. \tag{4.7}$$

The results are shown in columns 2 through 4 of table 2.

For the *Blue* states, shown in column 2, the standard channels–capital markets, fiscal flows, and saving–show only minor changes. However, smoothing through durables is notably higher. While still relatively small, the use of durable goods as

[25]While our migration findings are closely related to those of Dao, Furceri, and Loungani (2017) and to House, Proebsting, and Tesar (2018), who compare U.S. and European labour sensitivity to economic conditions, our work differs from theirs by estimating migration's role in smoothing consumption.

a saving device to smooth consumption–at almost four percent–is roughly double the estimate for the country as a whole. The point estimates for the roles of prices and migration are also substantially higher than for the country as a whole, however the estimates are noisy, so we cannot conclude that prices and migration are more responsive to economic conditions in *Blue* states than in the country as a whole.

The estimates for the *Red* states are given in column 3. There, the differences are more marked. Most importantly, in comparison with estimates from the country as a whole, *Red* states benefit much more from fiscal flows, yet they are nevertheless left with substantially more residual risk. As shown in the second pair of rows, fiscal flows insulate more than a quarter of the idiosyncratic risk faced by *Red* states. This compares with only 16 percent for the country as a whole. As shown in the last rows of estimates, *Red* states are left with unshared idiosyncratic risk of about 17 percent, which is significantly higher than the 12 percent faced by the country as a whole.

The use of durable goods as a saving device to smooth consumption in *Red* states is about a quarter what it is for *Blue* states, and the use of migration in *Red* states is about one-third of what it is in *Blue* states. Residual, unshared risk is highest for the *Red* states, and of all of the channels of smoothing, only fiscal flows is larger in *Red* states than in the rest of the country.

The estimates for the swing states, those that do not consistently vote *Blue* or *Red*, are given in column 4. Like the *Red* states, the biggest difference occurs in the fiscal flows. Perhaps surprisingly–and in contrast to both *Blue* and *Red* states–swing states benefit very little if at all from risk sharing through fiscal flows.[26] The swing states accomplish overwhelmingly the largest portion of their smoothing, almost 50 percent, through capital markets. And, swing states smooth much more through migration than do either *Red* or *Blue* states: their migration offsets another 15 percent of their idiosyncratic risk. Finally, while durables remain only a minor channel for smoothing, swing states do smooth more than average using durables.

Overall, there are substantial differences in the channels of smoothing used by the three regions. In terms of fiscal smoothing, *Blue* states might be thought of as

[26]The point estimate of six percent has a standard error of five percent, which renders it indistinguishable from zero at standard statistical significance levels.

being comparable to Canada, while *Red* states might be thought of as comparable to countries where fiscal flows are more important in this regard, such as the United Kingdom and Germany.[27] Swing states, in contrast, do not appear to systematically benefit from fiscal smoothing. Despite the extent of their fiscal smoothing, *Red* states are left with substantial unshared idiosyncratic risk. In contrast, *Blue* states use a breadth of channels to smooth virtually all of their idiosyncratic consumption risk, and swing states smooth a great deal of their risk through factor mobility.

5 Conclusion

This paper revisits the study of the United States as a benchmark for understanding business cycle synchronicity and the scope for sharing idiosyncratic consumption risk within a currency union. At the same time, it explores whether the politically divided regions within the United States share risk as if they exist within a single country. We find that the economies of the politically divided regions are more asynchronous than separate countries, but they share consumption risk more than separate countries do. We also find that the channels for their risk sharing differ markedly across the regions: their reliance on fiscal smoothing and on migration differs, as does the extent of their remaining, unshared idiosyncratic risk. Notably, *Red* states benefit the most from fiscal smoothing, yet they also end up with the most residual risk; while swing states rely the most on migration and benefit little, if at all, from fiscal smoothing; and *Blue* states have the least remaining risk.

The United States has stood out in the past as an exemplar of mobility of many types within its borders. Now, it stands out as one of the notable exemplars of regional political division. Our findings show that such political divisions may be attended by macroeconomic differences, but the divisions do not prevent the regions from risk sharing. The evidence suggests that political and economic differences do not necessarily prevent successful participation in a monetary union.

[27] See the summary of international work provided by von Hagen (1998).

A Data Sources

Much of the data used in this study comes from the Regional Economic Accounts of the Bureau of Economic Analysis (BEA), and is available online at `https://www.bea.gov/regional`, with methods described at `https://www.bea.gov/regional/methods.cfm`. The BEA provides: state GDP, state personal income, and state population. We use annual data from 1993-2015 in section 2, and since the BEA's introduction of state-level personal consumption expenditures data begins in 1997, we use 1997-2015 for the analysis of consumption smoothing in sections 3 and 4. An informative description of personal consumption expenditure data and methodology is provided by Awuku-Budu, Fallon, Kublashvili, and Zemanek (2013). For state level prices, we construct state-level consumer inflation using individual goods and services price data provided by the Council for Community and Economic Research, and using the fixed-weight methodology of the Bureau of Labor Statistics. Additional details are described in Parsley and Wei (2016). Finally, election results were compiled from data provided by the office of the Federal Register, `https://www.archives.gov/federal-register/electoral-college/map/historic.html`.

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