Comment on: "Structural and Cyclical Forces in the Labor Market During the Great Recession: Cross-Country Evidence" by Luca Sala, Ulf Söderström and Antonella Trigari

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1 Introduction

This interesting paper by Sala, Söderström and Trigari (henceforth SST) contributes to the ongoing debate on the causes of the Great Recession and the subsequent sluggish recovery in the US and three other European countries: Germany, UK and Sweden. Currently the list of candidate explanations for the Great Recession across the world is very long, as it includes disruption of financial intermediation, reduction in current or expected productivity, increase in uncertainty, bursting asset prices bubbles, sunspots and possibly others. One appealing feature of this paper is that it uses a unified framework, that includes a large variety of possible causes (modeled as shocks), and then let several aggregate time-series data, together with the model, speak on what are the shocks that caused the Great Recession. Although the paper presents a variety of results regarding the contribution of several shocks to the evolution of different variables in different countries, in this discussion I will focus on two connected results, which I found particularly interesting. The first result, which I will name the "*Risk premium hypothesis*" is that a so-called "risk premium shock" is largely responsible for the macro developments in US. The second result, which I will name the "*Two shocks hypothesis*"

*I thank seminar participants at the 2012 ISOM conference in Oslo. The data used to prepare this comment are available on the author's website

is that while the Great Recession has hit equally hard GDP both in Germany and in the US, SST found it to be driven by two different shocks: in the US the main culprit has been risk premium (softened by stable productivity) while in Germany the main cause has been a fall in total factor productivity and in the productivity of investment goods (softened by improving labor matching efficiency). Figure 8 in the SST paper (for convenience reproduced as figure 1 here) shows clearly these results: a large fraction of the negative growth of GDP is explained by risk premium in the US (the bars labeled "Risk P." in the panel (a)) and by productivity and shocks to the efficiency of production of investment in Germany (the bars labeled "Tech" and "Inv" in panel (d)).

In order better understand these results I will first take a broad look at the data, then use a very simplified version of the SST paper to recover their results, and finally comment on their plausibility.

2 A broad look at the data

Figure 2 presents five series (all starting in 2005 Q1 and ending in 2012 Q1, normalized to 1 in 2007 Q4) for the Great Recession and its aftermath, in US and in Germany. The panel in the first row reports real GDP, the two panels in the second row report employment and a measure of labor productivity, i.e. the ratio between GDP and employment. Finally the panels in the last row report real gross fixed capital formation and real private consumption. The first panel shows how the Great Recession hit in a pretty similar fashion US and Germany, as GDP fell by around 5% in US and about 6% in Germany. The second row shows how employment instead is different in the two countries, with employment in US falling sharply (by around 6%) while employment in Germany merely dipping and after that remaining on trend. As a consequence labor productivity merely blips and remain on trend in US, while falls more than 6% in Germany. Finally the panels in the last row of Figure 2 show how i) both countries experienced a severe contraction in investment, as investment in Germany and US fell by 15% and 20% respectively and ii) Consumption in US fell significantly (over 3%) but slowed down but did not fall in Germany. These figures capture some key features of the Great Recession, the first being the large and synchronous fall output and investment (for more on this see also Perri and Quadrini, 2012) the second being the fairly different outcomes in US and in Europe, for employment (see Ohanian and Raffo, 2010) and consumption.

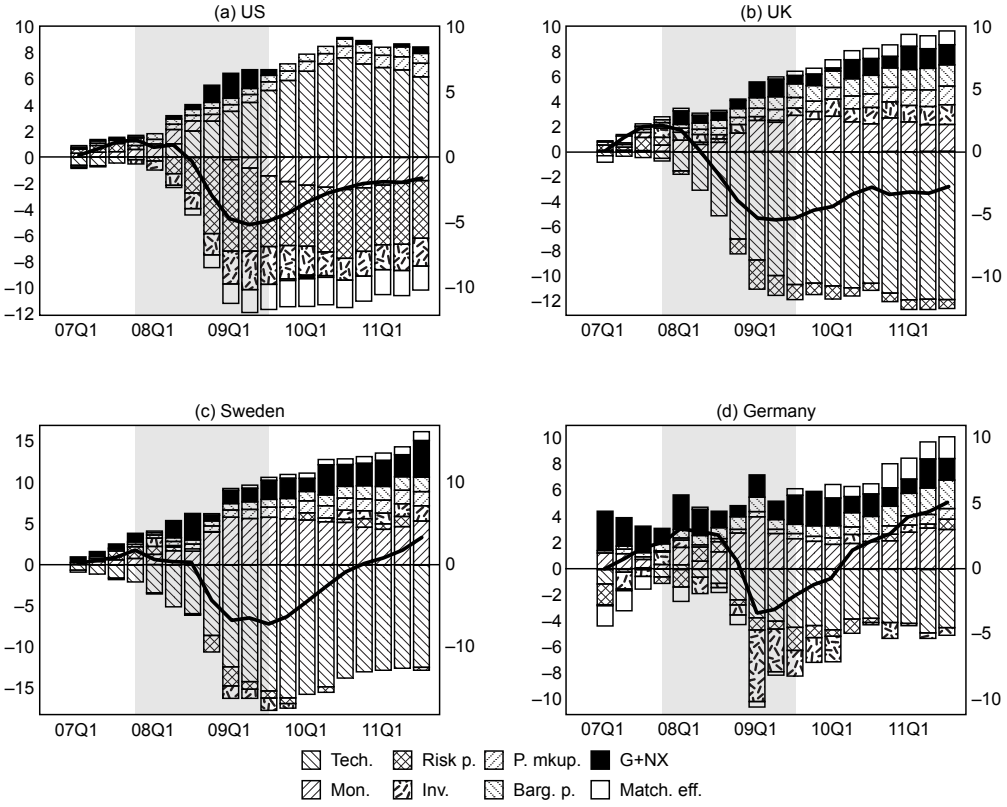

Figure 1: Driving Forces of the Great Recession in SST

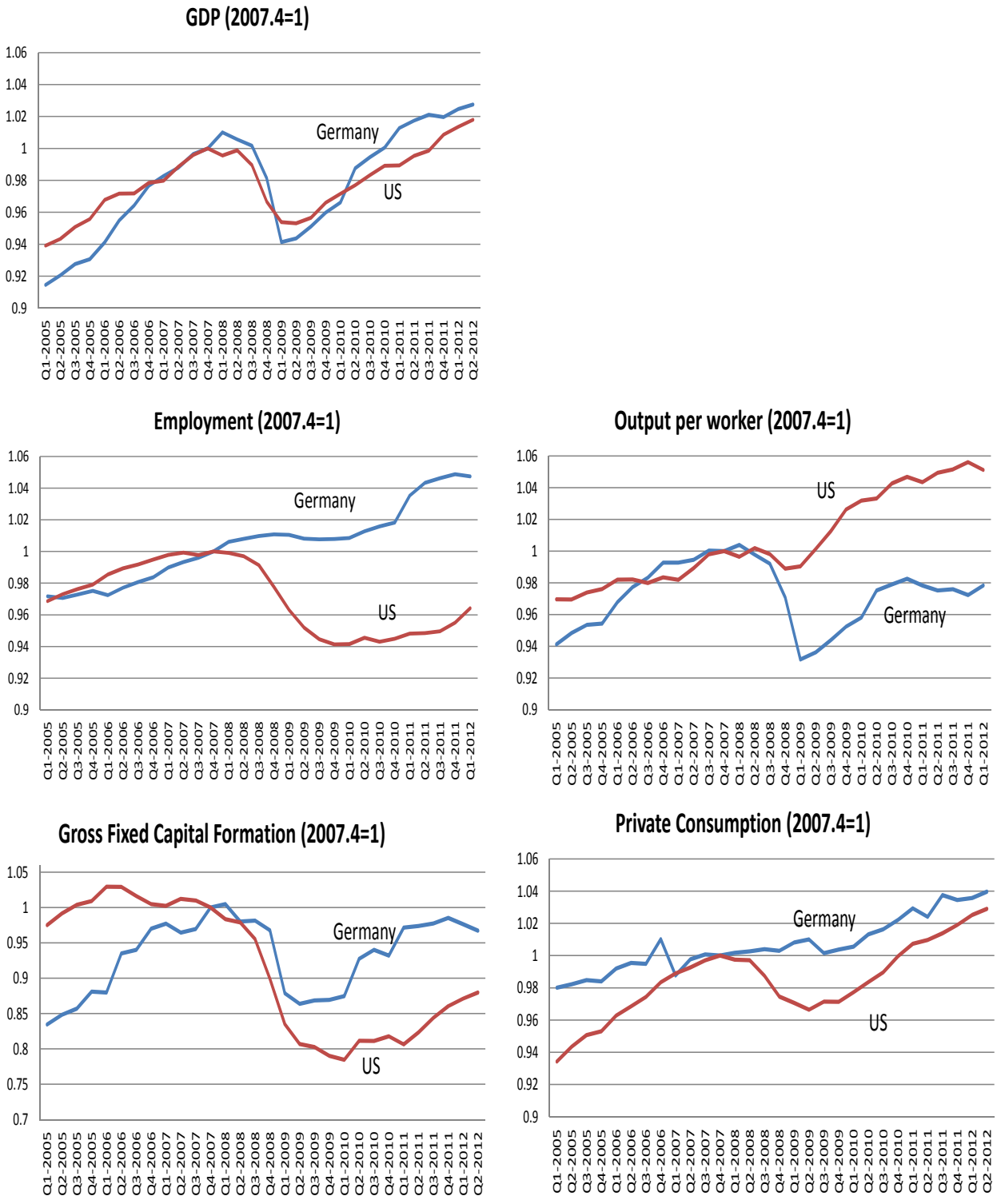

Figure 2: The Great Recession: US v/s Germany

3 From data to shocks

In order to illustrate how SST use the data above to identify shocks I am going to present an extremely simplified version of their model.

3.1 The set-up

This set-up will include three key elements of their model i.e. risk premium shocks, nominal rigidities that can prevent full employment, and frictions in the labor markets. Consider a closed economy inhabited by an infinitely lived representative consumer with standard preferences given by

$$E\sum_{t=0}^{\infty}\beta^t\left(\log(c_t)-\frac{\varepsilon}{1+\varepsilon}L_t^{\frac{\varepsilon}{1+\varepsilon}}\right)$$

where $0<\beta<1$ is the discount factor, c_t is consumption, $0<\varepsilon<\infty$ is the parameter determining the elasticity of labor supply, and L_t is labor supply. The representative consumer faces wages w_t and can trade a non contingent real bond b_t which pays an interest rate r_t so that in each period her budget constraint is given by

$$c_t+\frac{b_{t+1}}{1+r_t}=w_tL_t+b_t$$

Competitive firms own capital stock k_t and each period choose investment x_t and labor demand l_t to maximize the future discounted stream of dividends d_t i.e. to solve

$$\begin{aligned}
&\max_{x_t,l_t} d_0+E\sum_{t=1}^{\infty}\prod_{j=0}^{t-1}\left(\frac{1}{1+r_j}\right)d_t\\
&s.t\\
d_t &= A_tk_t^{\alpha}l_t^{1-\alpha}-w_tl_t-x_t-\phi(l_t-l_{t-1})^2\\
k_{t+1} &= (1-\delta)k_t+x_t\\
&k_0 \text{ and } l_{t-1} \text{ given,}
\end{aligned}$$

where A_t is process for Total Factor Productivity (henceforth TFP), α is the coonstant capital share in production, ϕ is a parameter determining the strength of the labor adjustment costs and δ is the constant rate of depreciation of capital. Note that the problem of the firm is completely standard with the exception of the presence of labor adjustment costs.

An equilibrium in this economy is defined in the standard fashion i.e as sequences for all the

quantities above that solve, given prices, initial conditions and process for TFP, the household and the firm maximization problems and which satisfy markets clearing in the goods market and in the labor market, which are, respectively

$$A_t k_t^{\alpha} l_t^{1-\alpha} = x_t + \phi(l_t - l_{t-1})^2 + c_t \quad (1)$$

$$l_t = L_t \quad (2)$$

3.2 The Great Recession

We assume that up to time $t = T-1$, $A_t = 1$ and that the economy has reached its steady state (i.e. an equilibrium in which all quantities and prices are constant). At time T unexpectedly, the Great Recession hits. We assume that a period in the model corresponds to two years in the data so that the Great Recession only lasts one period (2008-2009). During this period TFP A_t can change, labor markets possibly do not clear and there can be a shock to the real interest rate (more on this below). In period $T+1$, the economy returns to its normal state with $A_t = 1$ and with standard labor market clearing.

Productivity shocks are standard but the assumption of non-clearing labor market and interest rate shock is not, so we'll briefly discuss it. We assume that during the Great Recession equation (2) possibly does not hold and we replace it with the condition $r_t = \bar{r}_t$ where $\bar{r}_t$ is an exogenous value for the real interest rate (this is similar to the approach of Kocherlakota, 2012, and the underlying justification is the presence of nominal rigidities). In other words in the period of the Great Recession we'll treat $\bar{r}_t$ as a shock, which plays the same role as the SST risk premium shock. To see this, notice that in SST a risk premium shock is effectively a change to the marginal rate of substitution (MRS) of the consumers, $\frac{u_{c,t}}{\beta u_{c,t+1}}$, which in their paper is denoted by $\Lambda_{t,t+1}$ (to see this precisely see equation A24 in the paper). An increase in the MRS causes an increase in consumption growth (and so a fall in current consumption) through the Euler equation of the consumer and a fall in investment (through the Euler Equation of the firm). In this simple model $\bar{r}_t$ also acts a shock to the consumers' MRS and hence also causes a fall in consumption and investment. I think that the parallel is instructive as it suggests that the risk premium shock in SST is effectively equivalent to a shock to the real interest rate, which can only happen in an environment where the real interest rate is not at its market clearing level, due to some nominal rigidity.

3.3 The Risk Premium Hypothesis

We are now ready to use the model above to assess which shocks can generate the patterns in figure 2 above. Let's start with the US and verify the hypothesis in SST that the most important driver of the contraction in GDP and employment in the US has been the increase in risk premium, or in this simplified set-up, an increase in the real interest rate. In order to numerically assess the predictions of the model we first pick parameters values for β, δ, α and ε in a completely standard fashion (remember that a period in the model is two years). These parameters are reported in table 1.

Table 1. Parameter Values

Name	Symbol and value
Discount Factor	$\beta = 0.92$
Depreciation	$\delta = 0.2$
Capital Share	$\alpha = 0.3$
Elasticity of Labor Supply	$\varepsilon = 0.5$

The parameter ϕ, determining the cost of changing employment, is less standard and we set it to 0 capturing the idea that labor markets in the US are relatively flexible. We then assume that the Great Recession in US in driven by an increase in the exogenous real interest rate in a period in which labor markets do not clear. In particular we pick the increase in real interest rate (63 basis points, on a annual base) so that we match exactly the fall in GDP in US data. Table 2 reports the changes in GDP, employment, output per worker, investment and private consumption, in the data and those predicted by the model.

Table 2. US data and model's response to a 63 bp increase in real rate

		US Data* (07.4-09.4)	Model
% Change in:	GDP	−9.5	−9.5
	Employment	−7.8	−13.0
	Output per Worker	−1.6	+4.3
	Investment	−28.7	−29.0
	Private Consumption	−9.9	−4.1

*The numbers are growth rates over the 2007-2009 period minus the average (two-year) growth rate over the period 1997-2007 (to capture fall relative to trend)

Observe that a relatively modest increase in the real rate can generate a sizeable recession

in GDP and a larger one in employment, with labor productivity actually slightly increasing, a large fall investment and a sizeable fall in consumption, and thus is broadly consistent with US data.

An increase in the real interest rate causes a fall in current consumption and current investment, and this fall in aggregate demand (since this a closed economy) translates in a contraction in output and employment. If the economy had no nominal rigidities, the increase in interest rate and fall in aggregate demand would have not been an equilibrium, or, in other words, in such an economy the interest rate cannot be treated as a shock as is an endogenous variable. The underlying nominal rigidities, which are modelled here in a very stark fashion by dropping the labor market clearing condition, and in SST paper in a more structural fashion by having the staggered wages and prices, make the high real rate and low output a possible equilibrium path.

The overall conclusion is that a shock to real interest rate/risk premium, in the context of a standard model with nominal rigidities, can capture some features of the aggregate dynamics in the US, making the "Risk Premium Hypothesis" a plausible one. Obviously though this hypothesis does not tell us what drove the increase in real rate/risk premium/MRS and ultimately then what is the cause of the recession. It is conceivable that an increase in financial frictions (i.e. tighter borrowing constraints) due to falling asset prices, an increase in uncertainty, or a lower tolerance toward risk by agents or financial institutions are all possibly more structural factors in explaining the shock.

3.4 The two shocks hypothesis

In order to understand why SST find that the Great Recession in Germany is instead driven by technological factors we use the same model but assume that the recession is driven by a fall in TFP. Also, consistently with the estimates in SST, we introduce labor market frictions in Germany, by setting the parameter ϕ, determining the cost of changing employment, equal to 5. In Table 3 is first report data statistics for Germany and then report the model's responses to a 7% drop in TFP (A_t), chosen so to exactly match the drop of GDP in Germany. The table shows that if labor market frictions are strong, then employment in the model is basically constant in response to a productivity shock, output falls, and thus the model matches rather well the path of GDP, employment and thus output per worker in Germany. This (almost trivial) finding of our simplified model explains, I believe, why SST estimate productivity shock to have a large role for explaining the Great Recession Germany. Notice

though that the model over-predicts the drop in consumption and investment: a productivity shock implies a significant fall in consumption and investment, while in the German Data the fall in consumption and investment are smaller than predicted by the model. So the simple model in this discussion suggests that productivity alone is not fully consistent with the data. Indeed the SST procedure for identifying shocks uncover a counteracting shock, namely a positive monetary policy shock (the bars labelled "Mon" in figure 1), whose role, I believe, is to reduce the fall in consumption drop.

Table 3. German data and model's response to a 7% drop in TFP (A_t)

		German Data* (07.4-09.4)	Model
% Change in:	GDP	−7.6	−7.6
	Employment	−0.1	−0.4
	Output per Worker	−7.1	−6.9
	Investment	−16.6	−23.1
	Private Consumption	−1.3	−3.1

*The numbers are growth rates over the 2007-2009 period minus the average (two-year) growth rate over the period 1997-2007 (to capture fall relative to trend)

3.5 Discussion and Conclusion

Overall the hypothesis that an increase in risk premium is the main driver of the US recession is a bit reduced form, but entirely plausible. At the same time though the idea that US and Germany were hit, at exactly the same time, by a large risk premium and a by a large productivity shock, is a much harder sell. SST seem to acknowledge this problem, by stating that, "*The negative impact of technology shocks in the European countries may capture the reduction in output per worker due to labor hoarding associated, associated, in turn, with a reduction in hours per worker and, possibly, with a temporary reallocation of workers from productive to organizational activities.*". This statement though only begs the question: what drove the reduction in hours or the desire of shifting worker away from productive activities, in Germany and other European Countries? One could argue that an increase in risk premium could have been the driver in Germany as well; in particular an increase in risk premium would have caused a fall in demand and that, because of inflexible labor markets, would have resulted in stable employment and falling productivity. Yet the methodology in SST does not find evidence of increased risk premium in Germany, and the reason is that we do not see

private consumption falling in Germany.

I conjecture (and many commentators have also advanced this hypothesis, see for example Burda and Hunt, 2011) that in Germany trade might have played an important role in causing the fall in GDP. To support this conjecture Figure 3 plots the path for US GDP (right scale) together with the path for Germany real net exports (the left panel) and real net exports plus real government spending (right panel). All series are normalized to 1 in 2007 Q4. The left panel indicates that a large reduction in aggregate demand in Germany came from the reduction in net exports, and that the timing of the reduction in German net exports coincides with the recession in US (and in other countries), which is in turn explained by financial factors. So an alternative view to the "*Two shocks Hypothesis*" is that a shock to the risk premium drove the recession in the US and other financially fragile countries, which, through trade, caused the recession in Germany. Note that net exports in 2007Q4 in Germany were approximately 8% of GDP; since the left panel shows that they fell about 60%, they account for a reduction in aggregate demand which is almost 5% of GDP. Note that the reduction in aggregate demand due to net exports has not been compensated by public spending, as the left panel of figure 3 shows that public spending plus net exports also fell. Public spending plus net exports were in Germany in 2007.4 about 25% of GDP, since the right panel shows that they fell about 15%, they account for a reduction in aggregate demand which is about 15%*25%=3.75% of GDP, which is still sizeable. What is puzzling is that, although SST actually feed into their model the actual process for government spending plus net exports in Germany, they find that it has virtually no impact on Germany GDP (see the bars labeled "G+NX" in figure 1). Future research could investigate why this is the case, and possibly explore a variant of the SST model in which reductions in which a fall in net exports can affect GDP, and assess whether in such a variant productivity would still come out as an important explanation of the German recession.

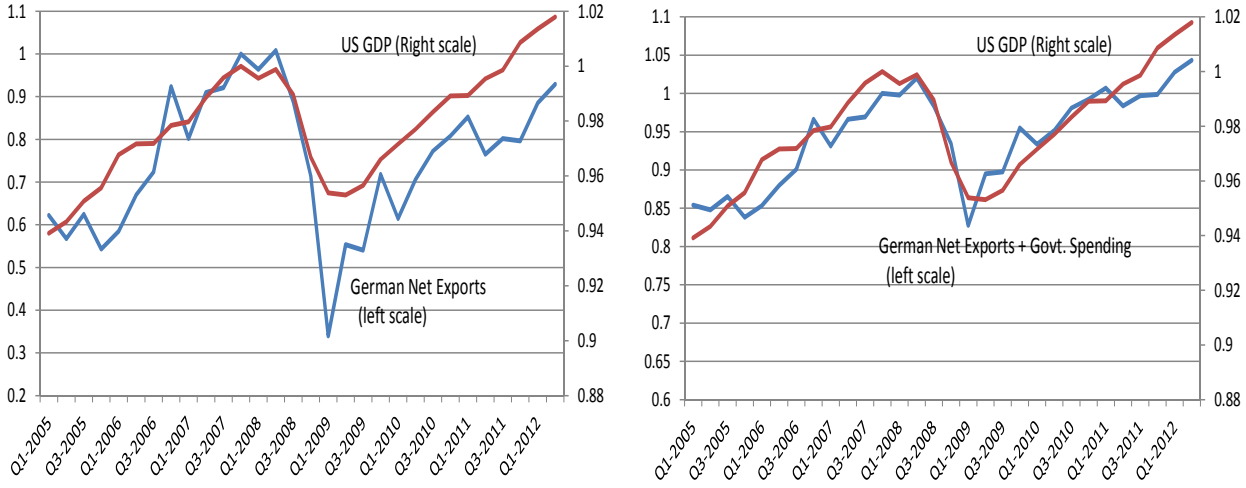

Figure 3: US Recession and German Net Exports

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