

On the Economic Consequences of Civil War

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Abstract

A model of the economic effects of civil war and the post-war period is developed. A key feature is the adjustment of the capital stock through capital flight. Post-war this flight can either be reversed or continue, depending partly upon how far the capital stock has adjusted to the war. The model is tested on data for all civil wars since 1960. After long civil wars the economy recovers rapidly, whereas after short wars it continues to decline. We then consider the effect on the composition of economic activity, distinguishing between war-vulnerable and war-safe activities. Evidence for Uganda shows such compositional effects to be substantial.

On the Economic Consequences of Civil War²

1. Introduction

This paper investigates the consequences of civil war for GDP and its composition. It focuses particularly upon the behaviour of the economy in the early years of a peace settlement. Civil wars are liable to be more damaging than international wars in several respects. They are inevitably fought entirely on the territory of the country. They are likely to undermine the state: both its institutions such as property rights, and its organisations such as the police. By contrast, as Herbst (1991) has argued, international wars tend to strengthen the state. The destruction wrought by warfare, and the erosion of institutions and organisations, constitute a deterioration in the economic environment. It might be expected that the ending of civil wars would produce a consequently large peace dividend. This paper argues that there is no presumption of a peace dividend from the ending of a civil war. Specifically, whether there is a peace dividend is shown to be contingent upon the duration of the war. The post-war growth rate can be either well above *or well below* that which would have occurred without the war. The end of civil wars can thus give rise to either a peace dividend or a *war overhang* effect.

Section 2 sets out the theoretical framework. The argument is that civil war reduces the desired stock of factors of production. Some factors are better able than others to leave the country and this gives rise to a gradual exodus of such factors. The behaviour of GDP during civil war thus reflects a gradual adjustment to a sudden deterioration in the environment. Both during the war and after it, the effects are consequently on the growth rate of GDP rather than simply on its level. Section 3 tests the theory on a comprehensive data set including all of the civil wars which took place during 1960-92, quantifying the effect of war and its aftermath on growth. Section 4 extends the analysis to the composition of GDP. Section 5 concludes.

2. The Effects of Civil War on GDP: Theory

Although the focus of the paper is on the recovery from civil war, it is useful first to consider the processes by which the economy is damaged during the war. The most obvious way in which civil war damages the economy is through the *destruction* of some resources. For example, part of the labourforce is killed or maimed and bridges are blown up. However, civil wars are usually fought with much lower technology than international wars and so tend to be much less destructive at least of physical capital. A second effect is the *disruption* caused by warfare and the often concomitant social disorder. For example, some roads become unsafe and so extra costs are incurred in achieving the same outcome. Civil liberties may be suppressed, and there is evidence that the suppression of such liberties will tend to reduce the efficiency of public expenditure (Isham, Kaufmann and Pritchett, 1996). While this is not unique to civil war, the breakdown of social order and the absence of a clear front line are more common to civil war than to international war. A

²I would like to thank Anke Hoeffler for research assistance and two referees for comments on a previous draft.

third effect is the *diversion* of public expenditure from output-enhancing activities. For example, as the army and its powers are expanded, the police force and the rule of law diminish. The enforcement costs of contracts consequently rise and the security of property rights is reduced. The costs of expenditure diversion arising from war have been quantified by Knight et al. (1996). Fourthly, to the extent that these income losses are regarded as temporary, there will be *dissaving* an effect analytically similar to the destruction of the capital stock. Finally, in response to the deterioration in the economic environment, private agents will engage in *portfolio substitution*, shifting their assets out of the country. Here, assets should be understood to include human as well as physical and financial capital.

Following the restoration of peace the destruction, disruption, diversion and dissaving effects are all directly ameliorated. However, the portfolio substitution effect depends upon private asset choices. The main point of the paper is to draw the implications of the portfolio substitution effect for postwar economic performance. Although it might seem esoteric to focus upon portfolio choice in the context of civil war, the sheer scale of capital flight from capital-hostile environments suggests that its effects on economic performance are likely to be large. For example, a recent study of how African-owned wealth is divided between domestic capital and foreign assets finds that the latter constitute 37 per cent of the total (Collier and Gunning, 1997). Despite foreign exchange controls, which until very recently have been prevalent in most developing countries, capital has evidently been expatriated. All types of domestic capital can gradually be transformed into financial capital by reducing gross investment below depreciation rates. With respect to physical capital, maintenance expenditures can be reduced. With respect to human capital, households can reduce expenditures on education and training and send more educated household members abroad. With respect to social capital such as reputation, firms can behave opportunistically, depleting reputation in return for short term profits. The resulting financial capital can then be removed from the country through illicit trade (under-invoiced exports and over-invoiced imports). In addition to these indirect processes of expatriation, some types of capital can be relocated abroad. Transport equipment and livestock are intrinsically mobile and so relatively easy to remove from the country. For example, in Mozambique during the 1980s the cattle stock declined by over 80 per cent (Bruck, 1996). *In extremis* even less obviously mobile physical capital can be removed. Kapuscinski (1988) describes the astonishing range of capital goods which were packed into crates and dispatched abroad at the onset of the Angolan civil war. A further instance of capital expatriation is the emigration of those with skills.

However, the exodus of factor endowments is a gradual process and the ease of expatriation differs between types of factor. Whereas some types of capital are highly endogenous, the supplies of buildings, land and unskilled labour are likely to be less responsive.³ As a stylised representation of these differences, dichotomise factor endowments into those which are endogenous with respect to war, denoted by N , and those which are exogenous, denoted by X .

³ There are some notable exceptions. For example, the land mines so common in Angola act in part as land-reducing technical regress, while the mass emigration of Hutus from Rwanda substantially reduced the labour force.

For concreteness, it is useful to characterise pre-war aggregate output in the simple Cobb-Douglas form as:

$$Q = a \cdot X^b N^{1-b}$$

The rate of return on the endogenous factor will be its marginal product minus its rate of depreciation, d . An initial equilibrium is assumed in which the rate of return equals the return, r , obtainable on foreign assets, so that:

$$(1-b)N^{-b} \cdot aX^b - d = r.$$

Now consider the effect of civil war on the supply of the endogenous asset. Civil war reduces the rate of return on N relative to that on the foreign asset. The *disruption* and *diversion* effects both reduce factor productivity. This lowers the multiplicative constant in (2) from a to a_w , thereby lowering the rate of return on N . The *destruction effect* is equivalent to an increase in the rate of depreciation. Similarly, the weakening of property rights is equivalent from a private perspective to a further increase in the rate of depreciation. Denoting the private rate of depreciation during wartime as $d_w > d$, the increase in depreciation again reduces the rate of return on N .

Assets held abroad will usually be liquid since this characterises most asset markets in developed countries. Civil war creates temporary uncertainty with respect to the future return on assets held within the country. If the war persists the return is lower than if the war ends for good. Such temporary uncertainty creates a premium upon holding assets in liquid form because such assets now have an option value in addition to their underlying rate of return, raising the overall return to r_w . The resulting increased attractiveness of liquid assets during civil war is an instance of the 'bad news principle' (Dixit and Pindyck, 1994).

As can be seen from (2), by increasing d and r while lowering a , civil war encourages portfolio diversion from N into foreign assets. The desired stock of endogenous factors will fall. This gives rise to a phase during which the actual stock of the variable factor is adjusting to its new desired level. The implication for GDP is that civil war would reduce output both through the disruption and diversion effects which are one-off because they directly reduce income, and through a phase of reduced growth as the stock of N declines relative to its counterfactual through destruction, dissavings and capital flight.

Now suppose there is a peace settlement. Although peace reduces the costs of economic activity in various ways, it does not reduce them to the pre-war level. With peace the destruction effect ceases, reducing the depreciation rate on capital back to its pre-war level. The disruption effect may also cease so that there is a one-off increase in productivity, although some aspects of the effect, such as the suppression of civil liberties, may only recover gradually. The diversion effect will be reversed by the extent of the fiscal peace dividend. However, this may be quite limited so that there can only be a partial restoration of productive public expenditures. Military expenditure might be

slow to decline: demobilisation is commonly delayed through fears of its consequences,⁴ and the government army may be expanded due to the influx of rebel forces, as in Zimbabwe. Even where military expenditure is reduced there might be little scope for increases in productive public expenditures: in the closing stages of war governments often adopt fiscally unsustainable positions. For example, in the final year of the Ethiopian civil war the fiscal deficit increased by 8 per cent of GDP.

Because of the persistence of the diversion effect, were the stock of N -capital fully restored its productivity would be below its pre-war level. This is one reason why although peace increases the optimal stock of the endogenous factor, it does not restore it to its counterfactual level. A second reason is that the level of risk is likely to have increased relative to the pre-war situation: a peace settlement will generally not restore expectations of peace to their pre-war level. The very fact of the civil war constitutes news that the society is prone to civil war. Further, it is likely to have polarised the society, so making it easier to coordinate future rebellions. These effects may be offset by the peace settlement: the rebellion may have been decisively vanquished, or peace may be guaranteed by external powers. However, as a general proposition, societies in the early years after a civil war are probably seen as facing higher risks than societies which have had long histories of peace. The probability of future peace thus rises on the news of current peace but the risk of 'bad news' does not fully revert to its pre-war level. This both maintains some, albeit reduced, option value on liquidity, and depresses the return on N relative to pre-war conditions. The increased probability of war relative to the pre-war situation reduces the expected productivity of only partially reversible investment relative to its pre-war level. Similarly, it raises the expected depreciation rate. Thus, the persistence of the diversion effect and the only partial credibility of peace both lower the return on N relative to its pre-war level. While the optimal stock of N increases as a result of peace, it does not fully recover its counterfactual value.

The response of the economy to peace depends crucially upon whether the stock of N has already adjusted below its newly optimal level. If it has not then the decline in N continues *as if there had been no peace settlement*. This might be termed a *war overhang* effect. Conversely, if N has already adjusted below its newly optimal level then the adjustment process goes into reverse. The supply of the endogenous factor can be increased by repatriation, giving rise to a gradual peace dividend.

Whether the stock of N has adjusted below its newly optimal level depends upon many dimensions of the adjustment process, most of which are unlikely to be measurable. However, one evident and observable dimension is its duration. *Ceteris paribus*, the longer the duration of the war the more likely it is that the supply of the endogenous factor has had the time to adjust below its post-war optimal level. Hence, the more likely it is that peace will produce a peace dividend rather than a war overhang.

The foregoing implies four testable hypotheses. First, because civil wars gradually reduce the stock of the endogenous factor, they reduce the growth rate of GDP rather than just its level. Secondly, because adjustment of the endogenous factor may have been incomplete by the time the war ends, peace may not end decline. Thirdly, because peace may reverse the exodus of the endogenous

⁴See Colletta et al. (1996) and Collier (1994) for a discussion of demobilisation experiences.

factor there is the potential for accelerated growth: that is there is a potential peace dividend. Fourthly, the longer has been the war the more likely is there to be a peace dividend rather than a war overhang. In the limiting case, a momentary war will lower the desired post-war stock of the endogenous factor without providing any opportunity for this reduction to be affected, so that the early post-war period will be characterised by a reduction in the growth rate. That is, sufficiently short wars will be characterised not by a peace dividend but by a war overhang.

3. The Effects of Civil War on GDP: Evidence

In this section the above hypotheses are tested on a comprehensive data set. The main issue is whether, as implied by the portfolio substitution effect, there is some critical duration of civil wars below which growth continues to be retarded in the post-war period, and above which there is a peace dividend.

Although no previous study has quantified the growth effects of civil wars and their aftermath, two recent papers are highly pertinent. Knight *et al.* (1996) have investigated the effects of war and quantified a peace dividend using a 79 country data set. Two of their results are important for the present study. The first is their panel regression of the ratio of investment to GDP. Warfare is found to have a strongly negative effect, being the most significant variable in the regression. While unsurprising, this is consistent with the underlying presumption of Section 2, namely that civil wars reduce growth mainly by depleting the domestic capital stock in its various forms. Indeed, when Knight *et al.* control for physical and human capital, together with military spending and trade policy, they fail to find a significant effect of war in their growth regression. The second result of importance concerns their estimate of the peace dividend. The source of the dividend in their study is entirely a reduction in military expenditure. That is, it is the type of dividend arising from the end of the Cold War rather than from the ending of a civil war. Indeed, Knight *et al.* specifically control for warfare in quantifying the effect of reduced military spending on growth: for a given propensity to warfare, they measure the gains from reducing the military budget. Further, they assume that the gains from reducing military expenditure are entirely symmetrical with the costs from increasing it. Their concept of the peace dividend from reducing military expenditure is thus close to the pure *diversion effect* postulated in Section 2: the cost inflicted by the squeeze of military expenditure on productive public expenditures. The other four effects of a civil war arise from directly or indirectly from violence rather than from the composition of public expenditure. Their principal finding, that increased military expenditure has significant negative growth effects, thus supports the postulate that the diversion effect is costly to growth.

The second pertinent study is that of de Melo *et al.* (1996) which investigates the effect of civil wars in the transition economies of Eastern Europe on the average growth rate over the period 1989-94. They include in their growth regression a dummy variable 'regional tension' for 'persistent internal conflicts or conflict-related blockades'. The variable is highly significant and reduces the annual average growth rate during the five years by 9 per cent. Since some of the conflicts ended before 1994 this conflates growth performance during the war with that after the war. However, because of the limited number of observations no distinction could be made.

The present paper explicitly quantifies the effects of civil war on growth both during the war and during the first five postwar years. The data set used for growth rates is the now-standard Penn World Tables, covering the period 1960-89. The innovation is to combine this with the standard source on civil wars (Small and Singer, 1982 and 1994). This data set gives the dates of the starting and ending of all civil wars since 1816 by month, defined on a common set of objective criteria.⁵ This permits a focus upon civil war as opposed to the wider concept deployed in both Knight *et al.* and the pioneering applied growth studies of Barro (1991). Combining the data sets provides a sample of 92 countries of which 19 had civil wars.

The dependent variable was the decade average per capita GDP growth rate of each country between 1960 and 1989. This makes the study directly comparable with other recent work on the determinants of growth such as Easterly and Levine (1998) and closely comparable to studies which take as the dependent variable the growth average over periods longer than a decade, such as Sachs and Warner (1995). The disadvantage with such a formulation is that the short term dynamics of the growth process are not analysed; the advantage is that by including only structural variables characterising the economy at the start of the decade the problem of endogeneity is reduced. In the main results presented below OLS was used as in Easterly and Levine, and Sachs and Warner. The results are then tested against fixed and random effects models.

Civil war is introduced into the regression through three variables which between them capture the effects both during the war and in the first five years of subsequent peace. The first, WARMONTHS, is the months of warfare during the decade. It measures the concurrent effects of war. The other two focus on the first five post-war years. One variable (POSTWAR) is the number of these potential recovery months during the decade. The other (LEGACY) interacts POSTWAR with the total length (in months) of the preceding war. Thus, a war which began in December 1957 and ended in December 1967 would potentially influence the average growth rate during the 1960s through there being 84 months of war, through there being 24 months of post-war recovery, and through these post-war months starting from a legacy of 120 months of war. It would also potentially influence the average growth rate during the 1970s through there being 24 months of post-war recovery, and through these post-war months starting from a legacy of 120 months of war. If there is a peace dividend irrespective of the duration of the war, then POSTWAR will be positive and significant whereas LEGACY will be insignificant. If, however, as postulated above, the duration of the war determines whether there is a peace dividend or a war overhang, then POSTWAR will be negative and significant and LEGACY will be positive and significant. There will then be some critical duration of warfare below which peace yields a war overhang instead of a dividend.

The other explanatory variables are all now fairly standard in growth regressions. Dummies for all three decades were included in lieu of a constant term, together with continent dummies. Two

⁵Singer and Small define civil war on three criteria: military action internal to the metropole, active participation of the national government, and effective resistance by both sides. This definition produces a classification which is somewhat too restrictive for our purposes. For example, Ethiopia is not classified as having experienced civil war on these criteria. In the present study their definition has been broadened slightly to include what they term 'extra-systemic' wars, which brings Ethiopia into the set, while still excluding inter-state wars. A fuller discussion of the Singer and Small data set is given in Collier and Hoeffler (1998).

endowments at the start of the decade were included: the level of secondary schooling (entered as a log), and the level of per capita income. It was found that the best functional form for income was simply its square. Two country-specific characteristics were included: the degree of ethno-linguistic fractionalisation and whether the country was landlocked. Easterly and Levine (1998) found that an index of ethno-linguistic fragmentation, measured as of 1960, significantly reduced growth. The index shows the chances of two randomly drawn people being from different ethno-linguistic groups. Although potentially the index might be correlated with civil war, Collier and Hoeffler (1998) show that highly fragmented societies have no greater risk of civil war than homogeneous ones. Sachs and Warner (1995) pioneered the use of a land-locked location as an explanation of slow growth. Being landlocked is a non-policy impediment to trade and most analysts find that trade promotes growth.⁶

Policy variables were omitted because some of the effects of civil war work through policies. For example, the portfolio substitution consequent upon civil war can be expected to increase the premium on the parallel exchange rate. There is indeed a high correlation between civil war and the size of the premium. Since the premium is often found to be the most important policy influence on growth (Easterly and Levine, 1997, Sachs and Warner, 1995) its inclusion would detract from the true effect of civil war. A similar argument could be made with respect to the fiscal deficit. Growth regressions tend to be sensitive to specification. However, this largely arises because many policy variables tend to be highly correlated so that depending upon which are included, quite different policies may appear to be important for the growth process. By excluding policy variables we are left with a less sensitive specification.⁷

The results, using heteroscedasticity-consistent standard errors, are reported in Table 1.

Table 1: Effects of Civil War and Peace upon the Growth of GDP

Variable	coefficient	t-ratio
DUMMY1960s	.0606	7.00*
DUMMY1970s	.0802	6.44*
DUMMY1980s	.0420	4.39*
AFRICA	-.0159	-3.37*
LATIN AMERICA	-.0235	-8.13*
INCOME SQUARED	-.00056	-4.10*
SCHOOLING (LN)	.0270	3.05*
FRACTIONALISATION	-.00023	-4.41*
LANDLOCKED	-.0056	-1.54
WARMONTHS	-.00018	-4.43*
POSTWARMONTHS	-.00022	-2.11**
LEGACY	.000040	2.25**

⁶ Possibly, ethno-linguistic fragmentation reduces growth by a similar process of impeding trade. Gravity models of trade flows find that if two countries share a common language trade flows are significantly increased (Foroutan and Pritchett, 1993). Hence, it may be the linguistic rather than the ethnic aspect of fragmentation which is costly for growth.

⁷For example, if the country or time dummies are dropped, although the performance of the regression deteriorates, the coefficients on the remaining variables are little changed.

* = significant at the 1 per cent level

** = significant at the 5 per cent level

Adj. r^2 = .42, F = 18.06, n = 259

Breusch-Pagan test = 32.02 (critical value for 95 per cent = 18.31)

Clearly, the non-war variables are not the focus of our attention, (although they are almost all significant). However, the 'convergence effect' has implications for post-war recovery: the coefficient on income indicates that poor countries grow faster than richer countries controlling for the other variables. A country with half the mean income would grow 2.5 per cent more rapidly than a country with mean income, evaluated at the mean of other variables. This provides some automatic peace dividend effect: if a country immiserises itself through civil war it will have an enhanced post-war growth rate by virtue of its poverty. This effect would predict that the post-war growth rate would be faster the longer the duration of the previous war. For example, a country which began a fifteen year war with mean income would add 1.7 per cent to its growth rate in the first post war year. However, since income at the beginning of the decade is one of the explanatory variables, this effect is largely controlled for and so is over-and-above the effects shown by the two post-war variables.

Now consider the effects of civil war. During civil war the annual growth rate is reduced by 2.2 per cent.⁸ A fifteen year civil war would thus reduce per capita GDP by around 30 per cent.⁹ The five post-war years must be assessed through the joint effects of the POSTWAR and LEGACY variables. The POSTWAR coefficient is negative whereas the LEGACY coefficient is positive, both being significant: short wars cause continued post-war decline, while sufficiently long wars give rise to a phase of rapid growth. During the five years following a war which only lasted one year, the growth rate would be 2.1 per cent lower than had the war not happened. This is not significantly different from the 2.2 per cent growth cost of the war phase. By contrast, after a fifteen year war the post-war growth rate is enhanced by 5.9 per cent per annum.

These results are consistent with the *war overhang* effect predicted for short civil wars and with the potential for rapid growth after long civil wars implied by the repatriation of previous capital flight. The prediction that there would be a continuing exodus of capital after short wars was based upon the proposition that the post-war environment is less capital-friendly than the pre-war environment. This is due partly to the persistence of the diversion effect, and partly to the increase in the perceived risk of civil war (which Collier *et al* (1998) have shown to be a rational expectation). Such a large persistence effect should depress the expected return on capital relative to its pre-war level for a given capital stock, giving rise to a war overhang effect. An alternative interpretation is that the risks of renewed war are perceived to be higher after a short war than a

⁸Since the duration of the war is measured in months and the dependent variable is the average growth rate during the decade, the coefficient on WARMONTHS must be multiplied by 120 to arrive at the effect on the annual growth rate.

⁹This estimate should be qualified. Because the dependent variable is the average growth rate over a decade, the range of the WARMONTHS variable is bounded at 120. A fifteen year civil war would be treated as (say) a 120 month war in one decade and a 60 month war in the next. The application of the coefficient on WARMONTHS to a fifteen year civil war is thus an extrapolation out of the sample range.

long one, since short wars may be inconclusive. In this respect the desired capital stock may be lower after short wars than after long ones. However, Collier and Hoeffler (1998) test for this and find that the duration of war does not have a significant effect on the probability of subsequent war. Hence, such a perception would not be a rational expectation.¹⁰

In the above OLS analysis the growth performance in each decade has been treated as an observation ignoring the information that the same country may appear three times. This is the model used, for example, by Easterly and Levine (1998). We now test the OLS model against fixed and random effects models.

In order to test against the fixed effects model the sample has to be reduced from 93 countries to 78 due to the lack of data covering more than one decade for a few countries. The OLS regression on the full sample was repeated for the sub-sample. The results are shown in Table 2. The OLS model is not rejected when tested against the fixed effects model. However, the reduction in the sample size reduces the significance of all the war-related variables, although the coefficients are little altered. WARMONTHS remains significant at 1 per cent but POSTWARMONTHS and LEGACY become insignificant. Hence, the panel can only be used to test whether WARMONTHS remains significant. WARMONTHS remains significant in the fixed effects model.

The random effects model can be tested on the full sample. Again the OLS model is not rejected when tested against the random effects model. The WARMONTHS and POSTWARMONTHS variables remain significant, although LEGACY drops a little below significance at the 10 per cent level. Overall, the tests do not provide a basis for rejecting the OLS results reported in Table 1.

Table 2: OLS versus Fixed and Random Effects Models

Variable	REDUCED SAMPLE				FULL SAMPLE	
	OLS MODEL		FIXED EFFECTS		RANDOM EFFECTS	
	coeff.	t-ratio	coeff.	t-ratio	coeff.	z-ratio
CONSTANT	.0354	3.86*			-.0416	-9.17*
INCOME					.0318	15.72*
INCOME SQUARED	-.00047	-2.59**	-.00045	1.51	-.00274	-10.66*
SCHOOLING(LN)	.0309	2.74*	.0337	1.55	.0136	1.74***
FRAGMENTATION	-.00023	-3.75*	-.00023	-2.07**	-.00020	-3.38*
LANDLOCKED	-.0078	-1.72	-.0060	-0.70	-.0085	-2.26**
WARMONTHS	-.00021	-2.96*	-.00020	-2.34**	-.00020	-3.83*
POSTWARMONTHS	-.00023	-1.05	-.00035	-1.14	-.00028	-1.66***
LEGACY	.0000032	0.93	.0000039	0.88	.0000042	1.38

* = significant at the 1 per cent level
 **= significant at the 5 per cent level
 ***= significant at the 10 per cent level

Fixed Effects Model versus OLS: F=1.085
 Random Effects Model versus OLS: Lagrange Multiplier Test: 4.61

¹⁰I am indebted to a referee for this point.

4. The Effects of Civil War on the Composition of GDP

The previous sections have focused upon GDP in aggregate. However, it would be surprising if, given the large aggregate effects which are caused by civil war, these were neutral between sectors. Sectors may differ both with respect to their susceptibility to the disruption and diversion effects and because they have different intensities as between endogenous and exogenous factors. These compositional effects are potentially testable but unfortunately require much more information than is presently available in the internationally comparable data sets, especially since data is particularly weak for civil war economies. The approach taken here is first to classify sectors according to their war vulnerability, and then to test the predicted change in the shares of groups of sectors using an unusually reliable set of National Accounts. The underlying hypothesis is that civil war affects the composition of activity partly through increasing the cost of transactions and partly through reducing the supply of N-factors.

The cost of transactions is increased by civil war through the destruction, disruption and diversion effects. The costs of transportation increase as infrastructure and security deteriorate, and the ability to enforce contracts is reduced as the institutions of civil society are weakened, trust declines, time horizons shorten due to uncertainty, and opportunism becomes more profitable. Turning to factor intensities, it is reasonable to expect that during civil war the supplies of physical and human capital will contract relative to land, buildings and unskilled labour. Again this changes the composition of the economy in two ways. Those sectors which are relatively intensive in capital tend to contract relative to the other sectors. Further, the fall in demand for physical and human capital reduces the output of the capital-providing sectors. A final demand effect is on the defence industry itself. However, most civil wars occur in low-income countries in which the defence supply industry is small. In Uganda it was negligible and it is not considered in the subsequent analysis.

To summarise, activities with any of four characteristics tend to contract: those which are intensive in either capital or transactions, and those which supply either capital or transactions. It is quite possible for an activity to have more than one of these characteristics.

Naturally, National Accounts are not disaggregated according to these characteristics. It is therefore not possible to make a comprehensive ranking of activities according to their vulnerability to civil war. However, some activities are sufficiently obviously distinctive that it is possible to make partial rankings. Sectors are now classified according to whether their characteristics are such as to make them manifestly war vulnerable, or manifestly war invulnerable, leaving those sectors which are insufficiently distinctive in a third, unclassified, category.

The most favoured activity would be one which was transactions-extensive, capital-extensive, and whose output was neither transactions services nor capital. Among the National Accounts categories these characteristics apply only to arable subsistence agriculture. Three groups of activities can be identified as disadvantaged. The fall in demand for domestic capital goods applies quite specifically to the construction sector. The fall in demand for transactions services will affect transport, distribution and finance. The main activity intensive in both capital and transactions is manufacturing.

This partial ranking assigns activities to three groups: war-invulnerable (arable subsistence agriculture); war-vulnerable (construction, transport, distribution, finance, manufacturing); and unclassified (all other activities). Six testable predictions follow from this assignment. The first three are that during civil war output of the first group would expand relative to GDP, output of the second group would contract, and, if the unclassified group genuinely consists of activities which are not atypically affected one way or the other, its share of GDP should not be altered. The remaining three concern the post-war period. The effects of civil war on the composition of GDP are not automatically reversed in the post-war period because the effect on factor supplies is not automatically reversed. As discussed in Sections 2 and 3, the period following short civil wars tends to be characterised by continuing loss of capital. Only after long civil wars is the decline in the capital stock reversed. Hence, it is only after long civil wars that peace unambiguously reverses the compositional changes. For such wars the predictions are therefore that the war-invulnerable group should contract, the war-vulnerable group expand, and the unclassified activities remain unaltered as shares of GDP.

Evidence on the effect of prolonged civil war on the composition of GDP is much more problematic than that on aggregate GDP. There is no international data set on the composition of GDP at constant prices comparable to those available for aggregate GDP.¹¹ In place of multi-country panels resort is made to data on a single country, Uganda, which experienced a fifteen year period of intermittent civil war. Uganda is particularly well-suited for such an analysis because, by the modest standards of a country which has experienced a prolonged civil war, its National Accounts are of good quality. Social disturbance on a massive scale began abruptly in 1972 when President Amin declared 'economic war' against the Asian community, triggering an exodus of human and financial capital, and an expansion in the army. The subsequent periodic warfare was resolved only in 1986 when the NRA guerrilla forces took Kampala. For a more detailed discussion of the effects of the war see Collier and Pradhan (1998).

By 1971 the Ugandan National Accounts were well-established so that the pre-war composition of the economy is known with reasonable confidence. During the ensuing fifteen years the quality of the National Accounts naturally deteriorated. However, the subsequent period of peace has been sufficiently long that they are now of quite high quality. Moreover, the National Accounts have recently been rebuilt back to 1986. One problem inevitable with long National Accounts time series is that there is a change of the base year in which the constant price series are measured. The treatment of this problem is discussed in the notes to Table 3.

Table 3 reports the composition of GDP according to the three groups of war-invulnerable, war-vulnerable and war-neutral activities proposed above. It compares the structure of the economy at constant 1991 prices in 1971 (the last pre-disturbance period), 1986 (the end of the civil war), and 1993/94.

No attempt is made to specify a counterfactual. Qualitatively, it is evident that the activity proxying war-invulnerability, arable subsistence agriculture, would normally decline as a share of GDP during

¹¹The Penn World Tables, which is the most nearly appropriate, does not provide a breakdown of activities suitable for the breakdown derived in Section 4.

the growth process, while those proxying war-vulnerability would increase, though not necessarily more rapidly than the war-neutral activities. Fortunately, in the case of Uganda the compositional changes are so dramatic that it is reasonable to attribute a substantial part of them to the effects of civil war.

During the period of the war, the war-invulnerable activity nearly doubled as a share of GDP whereas in the absence of war it would have been expected to contract. Conversely, the share of the war-vulnerable group of activities nearly halved. During the post-war period both of these changes were partially reversed, although even by 1993/94 the composition of GDP more closely resembled that at the end of the war than that of 1971. Despite these substantial changes in both directions on the part of the war vulnerable and invulnerable groups, the unassigned group maintained a share in the narrow range 37-40 per cent, suggesting that it indeed consists of activities which are at least in aggregate war-neutral.

Table 3: The Composition of Ugandan GDP by War-Vulnerability

(per cent share of GDP at 1991 constant prices)

	1971	1986	1993/94
War-Vulnerable Sectors	42.5	24.0	28.7
High transaction and asset intensity	8.8	4.4	6.0
transaction-providing	21.2	16.1	17.2
asset-providing	12.5	3.5	5.5
War-Invulnerable Sector	20.5	36.0	32.1
low transaction and asset intensity supplying neither transactions nor assets			
Unassigned Activities	37.0	40.0	39.2

Note: The National Accounts provide data at 1966 prices for 1963-85 and at 1991 prices from 1982-93/94. 1982 was selected as the year to be used for conversion from 1966 to 1991 prices. Since output changes 1971-82 are only measured at 1966 prices, the conversion of 1971 output to 1991 prices is only approximate. Sector I in 1971 at 1991 prices is approximated as: $[(\text{sector I in 1971 at 1966 prices}) / (\text{sector I in 1982 at 1966 prices})] \cdot [\text{sector I in 1982 at 1991 prices}]$. This has the advantage that since 1982-91 GDP was calculated upon a consistent set of definitions of sectors, changes in definitions between the 1966 series and the 1991 series only lead to a mis-estimate to the extent that they alter the growth rate of the sector between 1971-82. Total GDP in 1971 at 1991 prices was then calculated as the sum of the sectoral outputs so revalued. Note that this will differ from a direct adjustment of total GDP in 1971 by the factor $[(\text{total GDP in 1982 at 1991 prices}) / (\text{total GDP in 1982 at 1966 prices})]$. Sector shares in 1971 at 1991 prices are then sector output/GDP.

The six predictions concerning the composition of activity during and after a prolonged civil war are thus supported on the Ugandan data. This falls well short of a rigorous test, but it suggests that the hypotheses are worth pursuing on similar data sets for other countries which have experienced prolonged civil war. With sufficient data on sector shares at constant prices the war and postwar periods could be introduced as dummy variables in a time series analysis along similar lines to that of Section 3, with the dependent variable changed from the growth rate to sector shares.

5. Conclusion

Civil war is a sufficiently devastating phenomenon that it is likely to have large effects on both the level and composition of economic activity. This paper has proposed simple theoretical frameworks for these effects and tested them for war and post-war periods. During civil wars GDP per capita declines at an annual rate of 2.2 per cent relative to its counterfactual. The explanation proposed in this paper is that the decline is partly because war directly reduces production and partly because it causes a gradual loss of the capital stock due to destruction, dissaving, and the substitution of portfolios abroad. These affect sectors differentially. The sector intensive in capital and transactions (manufacturing), and the sectors which supply capital (construction) and transactions (transport,

distribution and finance), contract more rapidly than GDP as a whole. The sector with opposite characteristics (arable subsistence agriculture) expands relative to GDP.

Despite these severe effects of civil war the restoration of peace does not necessarily produce a dividend. Peace does not recreate either the fiscal or the risk characteristics of the pre-war economy: there is a higher burden of military expenditure and a greater risk of renewed war. The desired capital stock is consequently lower than had there been no war, although being higher than that desired during the war. Because downward adjustment of the capital stock is a slow process, that prevailing at the end of the war may still be above not only its desired wartime level but its desired post-war level. In this case, which is inevitable if the war is very brief, the decline in the capital stock can be expected to continue, yielding a war overhang effect. Empirically, if a civil war lasts only a year, it was found to cause a loss of growth during the first five years of peace of 2.1 per cent per annum, a loss not significantly different from had the war continued.

However, if the war has been sufficiently long the capital stock will have adjusted to a level below that desired in post-war conditions. In this case capital repatriation enables the economy to grow more rapidly than during the pre-war period. Empirically, this peace dividend for the ending of prolonged civil wars was found to be large.

Peace also reverses the compositional changes caused by prolonged civil war. An implication is that after the end of long wars the war-vulnerable activities experience very rapid growth: the generalised peace dividend is augmented by compositional change.

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