How can improved energy efficiency affect energy security?

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Keywords
energy security, energy efficiency measures

Abstract
Energy efficiency has in many cases positive effects on energy security, a concept that could involve not only security of supply but also demand and revenue; technological, social and environmental risk factors; geopolitical considerations as well as other political risk factors. The effects depend on kind of energy source, market structure and infrastructural preconditions. Lowered energy demand will reduce the stress on energy resources and support long-term energy availability. It also reduces the economic vulnerability to disturbances on the market, regardless of the reasons for disturbances. The risks for disturbances due to market imbalances will probably decrease in the short run but the positive effects might diminish in a long-term perspective, e.g. when energy markets adapt to lower energy demand levels and new supply and demand balances are established. There are however some exceptions when energy efficiency may entail negative effects, e.g. for energy suppliers' security of demand and revenue. Moreover, energy efficiency measures might entail fewer – but relatively more important – production facilities. Society will then be more vulnerable to malfunctions and production stops in a specific facility. When discussing the impact of energy efficiency improvements it is important to be specific with what the reference system is. Energy efficiency improvements that are overrun by increases in energy service growth can nevertheless improve energy security compared with a future case without energy efficiency measures, although energy security might be lower compared with the present situation.

Introduction
Energy efficiency is usually highlighted as a measure that provides multiple advantages in reducing emissions of greenhouse gases, stresses on other environmental resources, energy costs as well as improving energy security (e.g. IEA 2011a; EC 2011). Although there are many studies focusing on the environmental advantages of energy efficiency less interest has been directed towards impacts on energy security. One reason for this is perhaps due to the fact that energy security is a rather vague concept with many meanings, which are only partly possible to treat quantitatively. In this paper, we intend to make a small contribution by way of highlighting some of the relations between improved energy efficiency and energy security. Our aim is to nuance, discuss and problemize, not to report on evidence-based scientific conclusions. The paper should thus be considered as an 'idea paper', which might inspire deeper studies within this field.

In this paper we choose to understand energy efficiency in a rather strict and simple manner. Energy efficiency is using less energy to provide a certain energy service level. In the broader concept of energy conservation we also include energy savings gained from reducing energy service levels (e.g. indoor temperature). When it comes to energy security, there exist many definitions in both policy contexts and in academic works. In this paper, we use an existing framework (Johansson 2013). This framework takes its starting point in the notion that energy security could be understood from two different angles namely:

- seeing *energy system as an object* with focus on securing energy supply and demand, and the threats which would disturb the functioning of the energy system, and

- seeing the *energy system as a subject*, generating insecurity (or security) or functioning as a threat multiplier. This includes for example conflicts generated as a side-effect of the economic value of energy, and technological and environmental risks.

When evaluating the consequences of energy efficiency improvements with regard to energy security it is important to make distinction between if the improvements lead to absolute reductions of energy use levels compared to the current situation or if the reductions are relative a future reference level.

Securing energy supply and demand – potential effects from energy efficiency

SECURITY OF SUPPLY

Energy security is most commonly associated with *security of supply*, which can be interpreted as reliable access to energy resources (primary energy or energy carriers) at reasonable costs. This requires that there are available energy resources, a capacity to exploit and convert these resources to suitable energy carriers, and that there is a secure system for energy distribution. Security of supply includes both physical aspects (availability of energy to the consumer at the time of demand) as well as economic aspects (affordable and stable prices). Generally, much of the discussion regarding security of supply deals with factors like import and external dependencies (Ciuta 2010). A broader meaning of *supply* however, also includes domestic supply in terms of primary resources as well as conversion, production and infrastructure facilities (e.g. IEA 2011b). So the question is: How can improved energy efficiency affect security of supply?

Lack of energy resources and the inability to provide them to consumers will affect energy prices upwards which could have negative effect both to national economies and the economies of individual consumers. Exactly how the deficit will turn into price changes depend on the structure of the market. Depending on the character of the disturbance the price effects could be in the form of higher equilibrium prices or as price shocks. Energy efficiency improvements leading to a situation where energy costs constitute a less significant share of the economy compared with a society with no efficiency improvements would probably make the society less vulnerable to sudden price increases.

Energy efficiency as a unilateral security of supply strategy can entail improved national energy security in reducing vulnerability, but will probably only bring marginal positive effects on total resource availability and thus the risk for supply disturbances, at least when small countries are considered. Seen from a multilateral perspective, absolute demand reductions as a result of energy efficiency improvements mean less pressure on the limited resources, i.e. improving the long-term availability, resulting in some sort of collective positive security effect. International mutual understanding and trust are beneficial in order to avoid 'tragedy of the commons'-like social dilemmas (Harding 1968; Ostrom et al. 1999) related to energy security. When many countries join in common energy efficiency efforts there will in most situations be positive security of supply effects when the availability aspect is considered – at least in a short-term perspective, involving less stress on both energy resources as well as extraction and conversion facilities. In a long-term perspective the outtake of e.g. oil and gas will most likely be adjusted to fit demand, which might entail similar risks for short-term imbalances as today – however involving less volume. Nevertheless, for the individual country, although the risk for short-term disturbances is maintained, in the long run the vulnerability for the consequences in the form of price shocks will most likely be lower.

Distributional security is not very much affected by the size of the energy volumes. A functioning distribution is necessary regardless of volumes. Some energy carriers however, can be associated with infrastructural limitations in terms of e.g. transfer capacity in pipelines and cables. In those cases energy efficiency might contribute to improved distributional security and thus improved security of supply. This is relevant for line-shaped, grid-based and strongly coupled infrastructure systems (Kaijser et al. 1991; Perrow 1984), e.g. gas pipelines, electricity networks and railroads. Positive distribution security effects on more flexible node-based energy distribution, e.g. oil and LNG (Liquefied Natural Gas) via sea ports, when volumes are decreasing, are probably smaller.

Various energy efficiency measures may, in cases of cut-offs, affect vulnerability and resilience in different ways. When, for example, a power failure occurs in cold winter, it is better to have chosen additional insulation as efficiency measure for your house – compared with choosing very efficient electric heaters or heat pumps, since they will not work at all. On a higher system level, greatly diminished energy use due to energy efficiency measures, might entail fewer – but relatively more important – production facilities for e.g. electricity and transport fuels. Society will then be more vulnerable to malfunctions and production stops in a specific facility. Moreover, a radical efficiency regime may require optimizations in terms of advanced demand-side-management and intricately steered smart-grids. Whether that makes society more or less vulnerable to disturbances, cut-offs and other unwanted events, is still an open question.

A potential problem associated with an imagined future energy efficient scenario, for a specific energy usage system, is that there may be less room to manoeuvre towards even more efficiency in a more distant future – if this would be required politically or economically in order to handle an energy crisis. An example would be if, for some reason, a requirement for a proportional demand reduction was decided by e.g. the EU (e.g. 25 % for all countries concerned), which would probably cost an energy efficient society more since most of the low hanging fruits have already been utilized. This should, however, not be taken as a reason to avoid energy efficiency improvements, but indicate potential indirect negative consequences that could occur as a side effect and that these have to be taken into account when specific policies are introduced.

When we return to the broader *supply* interpretation, which not only includes imports but also domestic supply, some observations should be made. From a national perspective, increased efficiency might bring the opportunity to reduce imports, which has been the classic measure of security of supply. On the other hand, lowered demand and related price decreases might make (more expensive) domestic energy production less profitable which in turn could lead to lower investments in domestic production capacities. Although this is not a problem under normal conditions, it might entail increased supply risks in case of disturbances on international markets or distribution breaks due to e.g. natural disasters or wars. It is however difficult to convert this insight into conclusions for specific cases, as conditions vary due to specific energy system, market and governance structures. One important analysis to perform is to identify the fundamental limiting factor for availability of a certain energy resource.

SECURITY OF DEMAND AND REVENUE

The functionality of the global energy system is not only crucial for the energy consumers but also for *producers* and *exporters*. From their perspective, the most important negative effect of a disturbance in the energy system may be that *security of demand* cannot be maintained. Security of demand is the basis requirement for energy exporters in order to be able to sell their products, i.e. delivering energy to global energy markets or specific costumers – and of course get paid for it. Security of demand can be considered the inverted picture of security of supply. The basic requirements are thus the same; availability of energy resources and distributional security, associated with the same problems as described in the previous section. In addition, security of demand also needs availability of customers. The profound difference between the consumer and the producer in this context is that *energy per se* is essential to the consuming part, while the *revenue from energy* is essential to the consuming part. Conclusively, *security of revenue* is what it is all about for the exporter.

A routine-like conclusion would be that increased energy efficiency in importing countries would be a bad thing for exporting countries – analogous to the perception that energy efficiency brings improved security of supply. Energy efficiency improvements in importing countries, in combination with economic growth however, might entail preserved, or even increased, total volumes, which would secure energy revenues. Moreover, even if demand is reduced in absolute terms, prices can be maintained at high levels, or even increased, by way of lowering the availability through a decreased rate of energy outtake. Thus the revenue per energy unit might not be threatened – not even by energy efficiency measures resulting in decreased demand. Since the total revenue is a result of price as well as quantity, the question is if the exporter, in the short-term perspective, can afford to decrease production in order to maintain or increase prices.

Of course, if the visions of very efficient and carbon-constrained societies come true on a wide front, this would affect oil exporting nations in terms of reduced revenues. Then the exporters would probably have to consider diversifying the structure of the economy in order to decrease dependency of the energy sector. Diversification of customers can also be a strategy to meet more moderate changes. Long-term security of demand strategies might also involve securing market shares through long-term contracts or infrastructural lock-ins.

When it comes to limited resources such as oil and gas, the chosen time perspective in analysis is relevant. Maximize profits now or optimize over time? Decreased demand could, on the one hand, reduce prices and thus decrease the profitability associated with a certain resource and eventually stop production. Decreased demand, on the other hand, could make the resource last longer. Under the condition that a specific limited resource (e.g. oil) is not fully replaced by other alternatives (e.g. renewables) over time, the sum of revenues over the long-term perspective might not be affected that much by decreased demand.

Energy intensity, i.e. energy use / GDP, in exporting areas such as the Middle East and Russia is high (IEA 2012), often as a result of subsidized prices. Inefficient domestic use of energy decreases the available amount that can be exported, and thus export revenues. For example, around 25 % of Saudi-Arabia's huge oil production is used domestically where oil consumption for electricity production is growing especially rapidly (IEA 2012). The size of current energy subsidies in Saudi Arabia correspond to approximately 10 % of GDP (IEA 2011c). Improved energy efficiency in exporting countries would probably increase export volumes and thus security of supply (from the importers' perspective), but also increase security of revenue, since the exported energy is sold at market prices, which are higher than the domestic subsidized prices. More can be sold at higher prices.

Energy system generating or enhancing insecurity (or security) – potential effects from energy efficiency

POLITICAL RISK FACTORS

The energy system might *generate or enhance insecurity* in terms of political risk factors expanding the relevant policy arena to include security policy, foreign policy, geopolitics, and international relations, i.e. considered as an issue of national and/or international security, sometimes with military implications. Relevant aspects in this context are e.g. *political stability*, *political situation*, *political pressure*, the *energy weapon* and *resource curse*.

Political stability, or political situation, when referred to in the energy context generally refers to the conditions in an oil or gas exporting country in terms of form of government, institutional capacities, corruption, social tensions, poverty etc., sometimes mirrored by the United Nations' Human Development Index (HDI) (e.g. Kruyt et al. 2009), or the Geopolitical Instability Index (GPI) (e.g. Jun et al., 2009). On the one hand *political stability/situation* can be valued in a somewhat cynical way: for example, the lack of democracy does not matter as long as energy is continuously delivered. On the other hand the fact that energy imports might support repressing regimes can be regarded negatively in terms of human rights, and the security and well-being of the citizen in the concerned country (i.e. *human security*, see e.g. Alkire 2003). The *resource curse* (Auty 1993), or the paradox of plenty, is a related notion. Despite possessing an abundance of non-renewable resources, countries associated with the resource curse are overrepresented in terms of local and regional conflicts, less economic growth and worse development outcomes than other countries as a result of resource mismanagement, decline in the competitiveness of other sectors, or ineffectual and corrupt institutions.

Energy efficiency measures in importing countries resulting in less revenue for non-democratic exporting countries could, on the one hand, have a positive long-term security effect, in terms of human security, if it helps weakening repressing regimes. However, in the short-term perspective less revenue might destabilize the prevailing power structures, leading to social unrest and worsened conditions for people. In worst case uprisings meet with repression and violence or even civil war, which of course is a human security catastrophe in the short-term perspective, but might in the end result in a better society.

The notion on the energy weapon has to do with the willingness to use extortion, in terms of political pressure, in order to gain political, economic or security concessions in exchange for energy. Decreased dependency, as a result of energy efficiency measures, could decrease a country's vulnerability to the energy weapon as long as it is exercised in terms of price increases or supply reductions. If the risk is associated with total cut-offs of energy supply, energy efficiency will be little help as a strategy to reduce vulnerability. Here, diversification of energy supply is probably a better choice. The risks associated with international energy relations are, however, dependent on the context in terms of other frictions in the international system and specific power relations (see e.g. Lilliestam & Ellenbeck 2011, and Stegen 2011). Other decisive aspects are market structure, size and functionality as well as infrastructural conditions. For example, oil is traded on a global flexible market via shipping, making the energy weapon, for bilateral situations, rather ineffective. Under such conditions, the energy weapon is probably not enough in order to create an aimed supply cut-off towards a specific importer. The conditions for e.g. pipeline distributed gas, exclusively from producer to consumer are however more suited for an actor aiming to use the energy weapon.

Finally, indirect effects of measures aiming to increase distribution security (as a constituent part of security of supply, see previous section), might entail increased *securitization* (Buzan et al. 1998) and military involvement in the energy supply chain. Increased military presence – as a reaction to a perceived security threat – could be considered as another example of the *energy system generating or enhancing insecurity*. When a *referent object*, in this case energy, transforms from a political to a security issue, and civil politics becomes geopolitics with military involvement, the possible increased tensions in international relations might indirectly render new insecurities and possible conflicts (Buzan et al. 1998). In line with previous arguments, this indirect insecurity might be mitigated through less dependency and demand, especially if energy efficiency measures, as a part of a coherent energy policy, contribute to prevent the energy issue from passing the threshold of becoming a securitized policy theme.

SECURITY THROUGH INTERDEPENDENCY

In an energy security context dependency is often treated as something bad, something to avoid. This could be motivated by the fact that the energy system will be dependent on external factors that cannot easily be controlled by national governments. But when paying attention not only to the security of supply dimension but also security of demand, it becomes clear that dependencies are to various degrees mutual. A symmetric dependency, in other words a well-balanced relation, is considered to be something to try to attain, while asymmetric dependencies might be associated with economic and political risks (see previous sections).

Liberal international relations theories highlight interdependency as an important security building aspect (e.g. Russet et al. 1995). Mutually dependent countries with interconnected economies are, according to this school of thoughts, less willing to engage in political conflicts, or go to war, with each other. Interdependency is an example of the energy system generating or enhancing security. The cost of harming the bilateral interdependency relations is higher than the possible gains from a potential conflict. Neo-liberal international relations theorists rather highlight the intricate system of inter-woven interdependencies associated with continued globalization (e.g. Keohane & Nye 1997; Nye 2004). The more dependent countries are of each other, the more secure the world will be, which also brings security to single countries. The lubricants in this security system are the continuous global flows of information and ideas, people, capital, products, raw material and of course energy. Flow security has become the foremost in-word in this context (Ries 2010), and might be considered a part of a broad definition of the energy security concept.

This view throws over previous intuitive notions that dependency entails insecurity. Interdependency is not only strengthened by the number of links (e.g. external dependency of a number of energy sources) but also by the degree of economic interchange (i.e. large volumes of imported/exported energy). Conclusively, according to this perspective, energy efficiency measures resulting in decreased demand and possibly decreased volumes of trade and broken trade links, entails at least a small contribution to increased *insecurity* due to decreased interdependencies.

The idealistic and optimistic interdependency theory has however been strongly questioned, e.g. in terms of that interdependency does not eliminate struggle and conflict but rather alters forcible means (Mearsheimer 1994; Waltz 2000). Moreover, in reality there are no symmetric interdependencies, only asymmetric associated with various political risk factors.

Nevertheless, if we choose to accept the power of interdependency, it is by no way certain that the interdependency has to be built on energy imports and exports but it could as well be built of, for example, the exchange of other goods and services.

SOCIAL RISK FACTORS AND JUSTICE ASPECTS

The energy security debate generally set out from a, somewhat biased, Western World perspective. Energy security notions such as availability, accessibility and affordability (APERC 2007) are silently understood as the possibility to buy and distribute sufficient amounts of energy from global markets at prices not threatening the consumption based growth and pleasant life-styles of modern Western society.

However, although energy security would be high as an average, large differences may exist within as well as between communities. Energy poverty refers to when poorer groups have difficulties to afford even those levels of energy necessary to maintain minimum living standards. Support for energy efficiency measures directed to these groups would directly reduce their vulnerability. Energy efficiency measures conducted by more wealthy consumer groups or countries would also indirectly have a positive impact in reducing energy poverty as reduced demand would lead to falling energy prices, making the purchase of necessary energy carriers more affordable.

TECHNOLOGICAL RISK FACTORS

Energy security aspects associated with technological risk factors involve for example hydro power dam safety, security associated with nuclear materials, as well as explosive risks from fuels, etc. One part of this category can be associated with risks and safety issues during normal operation. For example, on the lower system levels electrical safety will not be affected by lowered demand due to energy efficiency, since risks are associated with voltage and amperage rather than volume. The other part can rather be associated with certain events or accidents, e.g. oil tanker oil accidents causing oil spillage. Technological risk factors can never be eliminated regardless of energy volumes, as long as the systems and associated facilities exist, but the flow volume can affect the overall probability of an accident to occur, e.g. the more oil tankers the greater risk. Also when certain systems are stressed near maximum capacity, risks are generally enhanced, especially in inherent immense complex systems (Perrow 1984). Even small amounts of energy efficiency measures have at least some possible positive energy security effects, regarding this category. Furthermore, significant demand decreases would probably give the opportunity to entirely eliminate certain more risk associated elements in the energy system, e.g. nuclear power.

ENVIRONMENTAL AND HUMAN HEALTH RISK FACTORS

The *energy system is also generating or enhancing insecurity* in terms of environmental and human health risk factors, which can be included in a broad interpretation of energy security. This category involves e.g. climate change, pollution, and land use. The relation between energy efficiency and particularly environmental effect is a well-researched theme, and it seems safe to say that energy efficiency generally entails positive effects. The conclusion is however dependent upon true demand decreases. Moreover, all environmental effects and health risk factors are not directly affected by decreased energy volumes, e.g. land use associated with infrastructure.

Discussion and conclusion

Our overview shows that energy efficiency can have positive effects on most aspects of energy security. Energy efficiency measures are probably good for security of supply in many cases, but the effects should not be exaggerated and exceptions have been identified. The effects differ depending on kind of energy source, market structure and infrastructural preconditions. Also positive short-term effects might diminish in a long-term perspective, e.g. when new supply and demand balances are established. The only energy security aspects with potentially strong negative outcomes are security of demand (and revenue) and security through interdependency. A modern, liberal and internationally oriented security policy strategy might be stated as to secure (and even intensify) global energy flows in order to strengthen interdependency, in line with continued globalization, which is considered as a stabilizing and a conflict restraining factor. But is that really *energy security*?

The effect on energy security also depends on from which actor's perspective we are evaluating security. The importance of energy efficiency improvements for enhancing energy security also depends on what other tools there are at hand for various actors to handle crises. Energy efficiency has to be weighed against other strategies as measures to improve security. A problem is that it is very difficult to estimate both the exact impact on energy security from energy efficiency as well as the value of it.

Energy security is, as we have shown, a broad and sometimes vague concept with aspects often hard to quantify. We should ask ourselves if the broad energy security concept becomes less useful as an analytical tool when 'everything' is included. Perhaps environmental issues, geopolitics and social risk factors should be treated separately? On the other hand, if energy security is limited to the narrow classic meaning involving just dependencies and costs, the comprehensive understanding which should form basis for policy will be lost.

Most of the positive effects of energy efficiency on energy security are due to absolute demand decreases (i.e. when energy efficiency improvements are large enough to compensate for increases in energy services), rather than relative demand decreases (i.e. when energy intensities is reduced while energy demand increases). When discussing the impact of energy efficiency improvements it is important to be specific with what the reference system is. Energy efficiency improvements that are overrun by increases in energy service growth can nevertheless improve energy security compared with a future case without energy efficiency measures, although energy security might be lower compared with the present situation. Furthermore, the economic effect of an energy price shock could be easier to handle also in a future with higher energy demand as long as energy efficiency improvements have seen to that energy's share of the total economy has been reduced.

Diversification strategies are commonly advocated in energy security policy contexts (e.g. EC 2008). There are no obvious links between diversification and energy efficiency strategies. But since both energy efficiency and diversification are generally regarded as beneficial for energy security in policy contexts, there is an obvious need to co-ordinate efficiency and diversification strategies in a coherent energy policy in order to avoid counterproductive outcomes. If energy efficiency is considered making society less vulnerable, the policy conclusion might be that diversification measures, associated with certain costs, are less important. On the other hand, a reduction in energy demand can lead to insecurity as the number of suppliers as well as domestic energy production facilities might be reduced, which calls for supplementary diversification policies.

References

Alkire, S. (2003). A Conceptual Framework for Human Security. CRISE Working Paper 2. Centre for Research on Inequality, Human Security and Ethnicity

APERC (2007). A Quest for Energy Security in the 21st Century. Asia Pacific Energy Research Centre [online], http://www.ieej.or.jp/aperc/2007pdf/2007_Reports/APERC_2007_A_Quest_for_Energy_Security.pdf

Auty, R.M. (1993). Sustaining Development in Mineral Economies: The Resource Curse Thesis. Routledge, London

Buzan, B., Waever, O., de Wilde, J. (1998). Security: A New Framework for Analysis. Lynne Rienner Pbl., Boulder

Ciuta, F. (2010). Conceptual Notes on Energy Security: Total or Banal Security? *Security Dialogue* 41(2).

EC (2008). An EU Energy Security and Solidarity Action Plan, Second Strategic Energy Review. European Commission, COM(2008) 781 final

EC (2011). Energy Efficiency Plan 2011. European Commission, COM(2011) 109 final

Hardin, G. (1968). Tragedy of the Commons. Science 162 (3859): 1243–1248

IEA (2011a). 25 Energy Efficiency Policy Recommendations – 2011 Update. International Energy Agency, IEA/OECD

IEA (2011b). Measuring Short-Term Energy Security. International Energy Agency, IEA/OECD

IEA (2011c). World Energy Outlook 2011. International Energy Agency, IEA/OECD

IEA (2012). World Energy Outlook 2012. International Energy Agency, IEA/OECD

Johansson, B. (2013). A broadened typology on energy and security. *Submitted to Energy*

Jun, E., Kim, W., Heung Chang, S. (2009).The analysis of security cost for different energy sources. *Applied Energy* 86(10): 1894–901

Kaijser, A., Mogren, A., Steen, P. (1991). Changing Direction: Energy Policy and New Technology. Swedish National Energy Administration, Stockholm

Keohane, R., Nye, J.S. (1997). Realism and Complex Interdependence, in Crane, G.T. & Amawi A. (red.): *The Theoretical Evolution of International Political Economy* . Oxford University Press, New York

Kruyt. B, van Vuuren, D.P., de Vries H.J.M., Groenenberg, H. (2009). Indicators for energy security. *Energy Policy* 37(6): 2166–2181

Lilliestam, J., Ellenbeck, S. (2011). Energy security and renewable electricity trade – Will Desertec make Europe vulnerable to the "energy weapon"? *Energy Policy* 39(6): 3380–3391

Mearsheimer, J. (1994). The False Promise of International Institutions. *International* security 19(3): 5–49

Nye, J.S., (2004). Soft Power and Leadership. *Compass: A journal of leadership.* [online] http://hbswk.hbs.edu/archive/4290.html

Ostrom, E., Burger, J., Field, C.B., Norgaard, R.B., Policansky D. (1999). Revisiting the commons: local lessons, global challenges. Science 284(5412): 278–282

Perrow, C. (1984). Normal Accidents. Living with High-Risk Technologies. Basic Books, New York

Ries, T. (2010). The Global Security Environment 2030 and Military Missions. Department for Strategic and Security Studies. Swedish National Defence College

Russet, B., Layne, C., Spiro, D.E., Doyle, M.W. (1995). The democratic peace. *International Security* 19(4): 164–184

Stegen, K.S. (2011). Deconstructing the "energy weapon": Russia's threat to Europe as case study. *Energy Policy* 39(10): 6505–6513.

Waltz, K.N. (2000). Structural realism after the cold war. *International Security.* 25(1): 5–41